

https://dspace.org/

Carbon encounters: cognizing the calculus of climate change

Battle, Angela

2016

http://hdl.handle.net/10539/22043

Battle, Angerla (2016) Carbon encounters: cognizing the calculus of climate change, University of the Witwatersrand, Johannesburg <http://wiredspace.wits.ac.za/handle/10539/22043>

Downloaded from a DSpace repository. https://dspace.org/

Carbon Encounters

Cognizing the calculus of climate change

Angela Battle
Student Number: 9803053r
June 29th 2016

I confirm that this research report is my own work, is not copied from any other person's work (published or unpublished), and has not previously submitted for assessment either at the University of Witwatersrand or elsewhere. I confirm that I have read and understood the University regulations on plagiarism.



TABLE OF CONTENTS

INTRODUCTION..... 4

CITY.....11

CALCULATIONS AND CENTERS.....16

CULTURAL BROKERAGE.....23

COMMODIFICATION.....31

COORDINATION 36

CONCLUSION 42

Introduction

Constitution Hill sits atop the highest peak in Johannesburg. It is presently the site of the South African state's apogee of justice, the Constitutional Court. But the site has had many uses over the years, primarily as a location of disciplinary bodies for the extractive industries' socioeconomic infrastructure in a region laced with gold. In the city's earliest days, there were Howitzer cannons atop the peak. Placed there in 1896, one of the ramparts was not aimed at the city's borders, to fulfill political obligations of defense as a means to thwart potential enemy invaders, but pointed directly into the city itself as a reminder to the hodge-podge of "Uitlanders" that the Boers, of the Transvaal Republic, ruled the geography. A rowdy, religiously, racially, politically and socially incongruent tribe invaded the city from all parts of the world in a quest for gold riches and the republic set up the outpost to keep a close eye on their activities. The Women's prison, built in 1910 after the defeat of the Boers in second Anglo-Boer war, is part of the Constitution Hill complex. The restoration architect successfully maintained a sense of foreboding --- fear squeezes the solar plexus when walking through its historic hallways. It, and the other remaining penitentiary sites on the hill, is Johannesburg's Bastille. It memorializes all of the women who suffered under Apartheid's regime of humiliation, brutality and inhumanity. The last time it housed prisoners was 1982. Although reconstructed and renovated to house meeting rooms and small offices, the unknowable and unrecorded acts of violence committed on female bodies still resonate through time into the present. It currently houses an exhibition space that has hosted events like a party celebrating the activist hero Helen Suzman's birthday, "Behind the Faces" – women's storytelling, and the provocative art installation, the "Screaming Vagina", which featured a walk-through pink structure that screamed and laughed hysterically as visitors entered. This exhibit had historical significance, since an induction into the prison during its operational period meant being strip-searched and having all crevices of one's body probed for contraband substances.

The old prison structure, although eerie, presents itself with a rigid elegance. The building is curvaceous, with all activities revolving around a grand central axis. The British, that built it, designed it as a panopticon, employing what was the state of the art in surveillance methods at the time. It allowed observation of the prisoners from a central point without the prisoners knowing whether they were, or were not, being observed. In *"Discipline and Punishment: The Birth of the Prison"*, Foucault describes effects of panopticism, on its subjects.

> "He who is subjected to a field of visibility, and who knows it, assumes responsibility for the constraints of power; he makes them play spontaneously upon himself; he inscribes in himself the power relation in which he simultaneously plays both roles; he becomes the principle of his own subjection." (Foucault, 1979)

It is on this site that the NGO, 350.org, has its meeting to discuss climate change. Is there any significance between the space and the topic? The question is unasked and unanswered, but the theme of Earth as a violated mother underpins the coming forum as well as the necessity for industrial surveillance. My friend Faarooq and I, are on the hill, along with about 50 other people, to learn more about what can be done to redress ecological harms inflicted upon the planet. The gathering is billed as "Joburg's first divestment dialogue." What follows here, on Constitution Hill, and the other sites of my research, could be considered just mundane discussions and initiatives from green activists; but at its core, the research touches on profound philosophical theories about societies' collective primal fear of regressing to "A State of Nature" in the

ascendency of carbon emissions as a global existential threat. The various "carbon encounters" in each chapter of this paper broadly survey ways in which human actants are working to preserve life and maintain a livable society. Although the location of the research is South Africa, societies across the globe are engaged in climate change fueled efforts, re-abstracting social contracts and reconstructing forms of sovereignty. These South African carbon encounters are part of a much larger climate change story that could be narrated numerous ways. I have chosen to showcase the importance of inscriptions, in the form of data, calculations, computer models, equations and numbers, play in addressing climate change --- and the tale begins with the number 350.

350.org's Global Executive Director, Mary Boeve, is in town and the event takes place as a panel discussion with Dr Dale McKinley, an independent analyst and consultant, Rashmi Mistry, acting Head of Oxfam's global GROW campaign and Ferial Adams a 350.org team leader.

"We must get organizations to divest from supporting the fossil fuel industry, says Dale McKinley; and "we must oppose the move to start fracking in the Karoo, it will kill the environment in that area.*"* As part of the presentation, the team debriefs, the audience on meetings held with a number of local banks. "They think we are just a bunch of wild-eyed hippies" Ferial says. "Its hard to get across to them the magnitude of what we are facing". 350.org's main target is Nedbank, which brands itself as South Africa's only "Green" bank. "You can't be green and own investments in coal companies" says Ferial.

350.org's name indicates their agenda. They ultimately would like to reduce the global measurement for CO_2 in Earth's atmosphere to 350 parts per million (ppm) from its current level of 400ppm. The underlying reasoning is, that at any level above 350ppm life on Earth is not sustainable in the long-run. These figures are based on research done by Dr. James Hansen at NASA and other scientists collaborating at other science agencies. Hansen et al are in disagreement with the United Nation's Intergovernmental Panel on Climate Change (IPCC) that has set a target of a 2^o Celsius rise in global warming as a maximum to prevent runaway GHG effects. The research, published in 2008 when the global CO_2 ppm was 385, argues that even a 1^o rise in global warming will equate to 450ppm of CO_2 emissions, precipitating a cataclysm. Their report ends with these apocalyptic paragraphs---

> Present policies, with continued construction of coal-fired power plants without CO_2 capture, suggest that decision-makers do not appreciate the gravity of the situation. We must begin to move now toward the era beyond fossil fuels. Continued growth of greenhouse gas emissions, for just another decade, practically eliminates the possibility of near-term return of atmospheric composition beneath the tipping level for catastrophic effects.
>
> The most difficult task, phase-out over the next 20-25 years of coal use that does not capture CO_2, is Herculean, yet feasible when compared with the efforts that went into World War II. The stakes, for all life on the planet, surpass those of any previous crisis. The greatest danger is continued ignorance and denial, which could make tragic consequences unavoidable. (Hansen, 2008: p 16)

What 350.org is trying to get across to NedBank, and other financial institutions, is the bigger picture, beyond mere pollution, that fossil fuels play in the world's ecology. Of the 7 recognized

Green House Gases (GHG), CO_2 is the most notorious, and the ppm measurements directly affects the global celsius temperature and contributes to a steadily heating planet.

In a 2009 article in Rolling Stone magazine entitled *"Global Warming's Terrible New Math"*, Bill McKibben, the head and founder of 350.org, discusses the Earth's "carbon budget". This is the amount of carbon mankind can put in the atmosphere and not warm the planet over the 2^o Celsius mark. He says ---

> This idea of a global "carbon budget" emerged about a decade ago, as scientists began to calculate how much oil, coal and gas could still safely be burned. Since we've increased the Earth's temperature by 0.8 degrees so far, we're currently less than halfway to the target. But, in fact, computer models calculate that even if we stopped increasing CO_2 now, the temperature would likely still rise another 0.8 degrees, as previously released carbon continues to overheat the atmosphere. That means we're already three-quarters of the way to the two-degree target.[1]

Scientists, he says, estimate that we can pour another 565 Gigatons of carbon into the atmosphere and maintain the budget. The bad news is that there are 2,795 Gigatons of carbon already contained in proven coal, oil and gas reserves of fossil fuel companies and countries. This is the fossil fuel that is still in the ground but is on tap for burning. It represents a number five times higher than what the budget allows. Hence, 350.org's push for fossil fuel disinvestment to keep the carbon in the ground.

So, the Earth has a "carbon budget". This is a measure of the amount of trauma the planet will endure without annihilation of mankind. Like a woman imprisoned, there is a limit to the lashes, confinement, rapes and deprivations, she can ingest and maintain a livable mind and body without becoming a hopelessly psychotic killer, viciously lashing out against her violators. What are these limits? Is there a tipping point, after which mankind is irrevocably condemned to a dystopian future? According to scientists, the answer is yes; the current carbon emission trajectory must be altered in order to maintain human existence. As evidenced by 350.org's struggle to gain credence with the banking community, the imperceptibility of climate change to the human senses, excepting to those beings attuned to the disrupted rhythms of the natural environment, makes climate change a fractionally accepted and contested argument from authority. Science must enter the domain of beliefs, politics, economy and more to persuade society as a whole.

The impact of the presence of 8 billion humans causing extreme weather events, environmental pollution, rising ocean levels and animal and plant extinctions is expected to result in a recognizable sedimentary record in Earth's rock layers. Our new epoch, the age of the geological Anthropocene, characterized by traumatizing human incursions on the earth's body through generation of greenhouse gases, intersects the technological age of Big Data. Big Data is the term that refers to the unprecedented exponential growth and availability of structured and unstructured data. As we spew the 7 corrosive Greenhouse gases (GHG), recognized by the United Nation's Intergovernmental Panel on Climate Change (IPCC), into the atmosphere (Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulfur Hexafluoride (SF_6),

[1] http://www.rollingstone.com/politics/news/global-warmings-terrifying-new-math-20120719

Hydroflurocarbons (HFCs), Perfluorocarbons (PFCs) and Nitrogen Trifluoride (NF_3)) mankind is simultaneously generating copious amounts of data everywhere and on everything; scientific knowledge, propelled by climate change, is immigrating to the realm of the every day. The "carbon budget" is an acknowledgement that mankind must live within limits and boundaries. There is no place to flee. Carbon has created carceral realities. Carbon knowledge, in order to become actionable, must be imbibed and embodied across varied landscapes and ethnoscapes (Appadurai, 1986). The problems presented by the "carbon budget" invites prospects and quests for ecological omniscience to regulate and ration GHGs, and identify and restrain the spendthrifts; it elucidates the necessity of a panopticon on a global scale.

In this paper, my working premise is that, scientists are correct, and the Anthropocene marks the initiation of an unforeseeably long and contentious relationship between humanity and the planet. In fact, every major shift in geological period in earth's history has been separated by a cataclysmic geological or paleontological event. Climate change and its concomitant acts of violence are nothing new. There have been five mass extinctions, catastrophic volcano eruptions, meteor impacts, mass releases of methane that have radically affected the earth over its 4.5 billion year history. The Anthropocene is the first occasion that mankind is consciously and collectively on the planet's surface as homo sapien sapien as a victim of the violence as well as its cause. I will reiterate the centrality of violence throughout the paper. I do this in an effort to underscore the role that Earth plays as an actant in the era of the Anthropocene as the Marrianne-esque character of the climate change terror, reasserting sovereignty over her body. The major thinker I rely on is Bruno Latour; following many of the arguments he makes in the paper *"Visualization and Cognition: Drawing Things Together"* (1983*).* The research is then aided by Walter Benjamin, whose essay *"Critique of Violence"(*1996) is the platform on which to theorize that new "laws" are an inevitable outcome of violence…of a regime change. In the case of this new epoch, new laws are being made and involve contemporaneous acts of inscription by the collection, creation and circulation of carbon knowledge. The advent of the Anthropocene has created the need for a "carbon gaze", new, informal, power relationships, as a way to regulate ecological deviance and disorder. These ideas about diffused power are well-established theory from Michel Foucault.

The chapters of this paper look at various ways climate change inscriptions, based on carbon, circulate within society.

> The chapter entitled **City** introduces Johannesburg as the site of the first, and all subsequent, encounters. It occurs in a Carbon Analyst course. It sketches out the basics of carbon footprinting and also examines South Africa's proposed carbon tax legislation. In addition it looks the industrial history of the region and countenances the calculative impulse of the city.
>
> In the next chapter, **Calculations and Centers**, we are still in the carbon class and depart for a discussion on the social calculus of climate change. In addition we look at the history of climate calculations and movement of immutable mobiles to what Latour calls "centers of calculations".
>
> **Cultural brokerage** is the subject of the third section. It examines the process of "fact creation" as a critical effort in the production of scientific knowledge. The scientific nature of climate knowledge necessitates the role of brokers to bridge knowledge from

> scientific labs to the social spaces. The role of the broker is defined as the ability to infuse society with new ecological norms and behaviors.
>
> The **Commodification** chapter leaves the realm of carbon-footprinting and takes a Marxian look at another carbon measurement --- carbon credits. The carbon-credits are created in bamboo fields in the Lawley township on the outskirts of Johannesburg and connect the Global South with carbon markets in the North. Issues of carbon in the realm of global finance and post-colonial control are discussed.
>
> The final chapter is on **Coordination.** This encounter takes place at a climate change gathering where South Africa's input to worldwide effort to address global warming is discussed. Another inscription, the Intended Nationally Determined Contribution (INDC), is the focus of the chapter. In this chapter we look at global climate change coordination efforts as constituting a global praxis similar to South Africa's truth and reconciliation process.

The research will primarily employ mobile ethnography techniques --- following carbon using participant observation, interviews and textual analysis as it connects various actors and assemblages .The methodology stems from Actor-Network Theory (ANT) used extensively in Science and Technology (STS) studies. Tracing the inscription making process means following a network of connections created by what Latour terms "immutable mobiles". These immutable mobiles flow between actant networks (human and non-human) in various spaces. In the case of my research, the immutable mobiles are the carbon inscriptions in the form of carbon footprints and other carbon measures.

In addition to Latour, Benjamin and Foucault, I make use of classical and established anthropological/ philosophical ideas from Appadurai, Derrida, Durkheim, Ferguson, Geertz, Marx, Mauss, Mitchell, and Simmel. I also engage economic thinking from Coase, Lohmann and Dikgang. Contemporary anthropological theories related to political ecology, politics, materiality and inscription are explored with Agrawal, Gibson, Gore, Hamilton, Jezewski, Nixon and Miller. I breach the social science boundary by using geographical/scientific sources (Crutzen, Edwards, Renear). Much knowledge about the Anthropocene was gleaned from Achille Mbembe's University of Witwatersrand Winter 2015 class on the *"Social and Cultural Meanings of the Built Environment (ANTH 7019)"*. Given the contemporary relevance of the topic, I liberally explore a wide variety of available grey literature (URL links, government documents, website references). The research took place with the full knowledge of the participants and there were no ethical considerations.

This research attempts to answer the questions around the processes and motivations that prompt various types of data collection and analysis, particularly on GHGs. **What types of new inscriptions and archives is mankind creating to manage the threats of climate change? In what ways are humans interacting with these inscriptions and mobilizing them across geographies?** I will rely heavily of Latour's view of inscriptions described as follows:

> The essential characteristics of inscriptions cannot be defined in terms of visualization, print, and writing. In other words, it is not perception that is at stake in this problem of visualization and cognition. New inscriptions, and new ways of perceiving them, are the results of something deeper. If you wish to go out of *your* way and come back heavily

> equipped so as to force others to go out of *their* ways, the main problem to solve is that of *mobilization*. You have to go and to come back *with* the "things" if your moves are not to be wasted. But the "things" have to be able to withstand the return trip without withering away. Further requirements: the "things" you gathered and displaced have to be presentable all at once to those you want to convince and who did not go there. In sum, you have to invent objects that have the properties of being *mobile* but also *immutable, presentable, readable* and *combinable* with one another. (Latour, 1983: p7)

"Immutable Mobiles" a term coined by Latour, are the main object of study of this research report. As evidenced by 350.org's quest to reduce the carbon ppm of the earth, empirical measurements and the resulting data are the enabler of panopticism for an Earth on which mankind is slowly reimagining it's penal, or more accurately, its reformatory existence. Money is a secondary form of immutable mobile the research will also examine. The research takes place as a series of "encounters' that looks at the creation, collection, calculation and circulation of carbon knowledge in the form of these immutable mobiles. The Anthropocene is a new age of discovery. Just like explorers of the past went to far away lands to gather data to bring back to imperial metropoles, contemporary data gatherers are also involved in equivalent acts of "taking something back to Versailles". This time, however, the modern Louis XVIs are not absolute, Hobbesian-style sovereigns with the arbitrary power to "take" life or "let" live (that power now resides with the Earth itself) as they expand empire, they are mostly democratic societies adhering to 21st century governmental practices as outlined by Foucault's definition of the biopolitical, and now have powers to "make" live and "let" die (Foucault, 2003: p 241).

The human race is furiously looking for ways to "make" life in an increasingly toxic world. "Making Life" is undertaking technological innovations and electronic immutable mobiles. Foucault explains ----

> "this technology of power, this biopolitics, will traduce mechanisms with a certain number of functions that are very different from the functions of disciplinary mechanisms. The mechanisms introduced by biopolitics include forecasts, statistical estimates and overall measures. And their purpose is not to modify any give phenomenon as such, or to modify a given individual insofar as he is an individual, but, essentially, to intervene at the level of their generality. In a word, security mechanisms have to be installed around the random element inherent in a population of living beings so as to optimize a state of life." (Foucault, 2003: p280)

Foucault presages the environmental issues currently facing mankind ---

> "Biopolitic's last domain is, finally --- I am enumerating the main ones, or at least those that appeared in the late eighteenth and early nineteenth centuries: many others would appear later --- control over relations between the human race, or human beings insofar as they are a species, insofar as they are living beings, and their environment, the milieu in which they live. This includes the direct effects of the geographical, climatic, or hydrographic environment: the problem, for instance, of swamps. And of epidemics linked to the existence of swamps throughout the first half of the nineteenth century. And also the problem of the environment to the extent that it is not a natural environment, that is has been created by the population and therefore has effects on that population. This is essentially, the urban problem." (Foucault, 2003: p 244)

"Governmentality" is the word coined by Foucault to describe how official power is exercised over the population within a domain. In terms of the environment, the term "Environmentality" is an extension to the concept, and was put forth by Arun Argawal to describe government's use of power specifically in the area of environment. In this study I look at the generation, analysis, interpretation and circulation of data and its role in defining spaces and subjects in the era of the Anthropocene. Biopolitics, as we shall see, has by necessity, transcended sovereign governments and has become a coordinated, united quest for management of unseen environmental forces, not only by government, but also in various spaces within civil society. The world has a "carbon budget". This means that the continued habitability of the planet is dependent on humanity living within global constraints. South Africa is an instance of a "situated globality" where social relations based on climate change extend from local collectives to the global assemblages (Block 2010). This necessitates a two-way dialogue between the global and the local or more ecologically speaking--- between the planetary and the commons. The need for constraints must be communicated downward and the results of constrained behavior must be communicated upward as input in to tracking the carbon budget. Somehow human actors must, without knowing the actual numbers, cognize the carbon budget and ideally self-impose limits on their carbon generating actions. New ethics are in play. The famous statement by Jean-Jacques Rousseau that "Man is born free, but everywhere he is in chains" is truer today than it ever was. Mankind is no longer morally free to act in ways that injudiciously generate GHG gases into the planetary commons. In the age of the Anthropocene, the social contract that apportions freedom is now global in scale and scope.

City

Cities are on the forefront of climate change data collection; so there are plenty of datasets in the city. In terms of human impacts, cities have much at risk. Also, they are the source of most anthropogenic gases. 37-49% of global GHG emissions come from cities, urban infrastructure accounts for 70% of global energy use, and over 64% of the world's population will live in cities by 2050 (Floater, 2014). Johannesburg, the city, today is a member of the C40, an international organization of cities committed to finding and sharing solutions to combat climate change. The first city-wide GHG emission inventory for the city was conducted in 2011. The city measured emissions at 26,226,549 (26.2 mil Mt) metric tonnes of carbon. By comparison New York City is measured at 53.36 mil Mt, and Paris was 24.6 mil Mt. An aspect of the city that the Joburg GHG doesn't take into account is the amount of carbon stored in the cities' trees. Schaffler and Swilling (2013) estimate that Johannesburg's forest stores about 5.3 mil Mt of carbon, which would offset the cities emissions by around 20%. South Africa is the biggest emitter of GHGs in Africa. It is ranked the 11th highest carbon-polluting nation in the world, and the city of Johannesburg releases the most emissions. Although, in the global scheme of things, South Africa's contribution, at 1.1% of worldwide GHG emissions, is small compared to the top 5 emitters (China, 25.36%; USA, 14.4%; EU,10.16%;India,6.96%;Russia,5.36%). But in a situation where there are possible "tipping points", every emission counts.

Given South Africa's premier GHG position in Africa, it is appropriate that my central encounter with carbon takes place via a carbon footprinting class in Johannesburg, South Africa. The course is taught by the Terra-Firma Academy, which proclaims ---"Our mission is to create experts through specialist training who will have a positive contribution towards preserving our environment for generations to come." A carbon footprint is broadly defined as "the total sets of greenhouse gas emissions caused by an organization, event, product or person." Theoretically, it is possible to scale up carbon footprints from measurement of an individual to measurement of the entire planet, to understand how much GHG is emitted into the atmosphere. As an entrée into the world of climate change, learning to conduct a carbon footprint analysis provides exposure to a wide range of concepts. I consider this a worthwhile exercise in pursuit of an understanding of the manufacturing techniques of climate knowledge. I hope it will also provide the necessary basic information to unpack the climate change discourse and to theorize it more thoroughly under an anthropological lens.

	Greenhouse Gas	Global Warming Potential (GWP)
1.	Carbon dioxide (CO_2)	1
2.	Methane (CH_4)	25
3.	Nitrous oxide(N_2O)	298
4.	Hydrofluorocarbons (HFCs)	124 – 14,800
5.	Perfluorocarbons (PFCs)	7,390 – 12,200
6.	Sulfur hexafluoride (SF_6)	22,800
7.	Nitrogen trifluoride (NF_3)[3]	17,200

Figure 1 - GHG Equivalents- IPCC (2007). IPCC Fourth Assessment Report: Climate Change 2007. Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge

The class takes place in the leafy Rosebank suburb in a large sprawling venue that appears to be a former opulent residence converted into a meeting complex. We are enchanted by the sounds of

fountains and the feathered displays of the resident ornamental peacocks. It's a three-day course with an attendance of about 30 people. The attendees are from diverse backgrounds --- University lecturers that want to incorporate environmental issues in their courses, A senior manager at a car rental company concerned about emissions from his vehicle fleet, A hotelier who wants to make her establishment more "green" and consultants who want to make a business out of carbon-footprinting, I discover "carbon" is the term that covers all the greenhouse gases. We will actually learn about CO_2e ; the e is for "equivalent". All the 7 official GHGs are measured in terms their destructive potential relative to carbon (CO_2). The different materialities of the 7 GHGs are used in relation to carbon dioxide as a baseline. For example, a methane molecule is said to have a global warming potential (GWP) of 25 meaning that it is 25 times more corrosive to the atmosphere than a carbon molecule. So small emissions of methane will have a larger CO_2e factor. Encoded into the calculation of GWP is the lifetime of each gas. Carbon stays in the atmosphere, on average for 100 years, whereas methane is in the atmosphere for 12.4 years. Carbon's longevity as an atmospheric gas, which makes it a practical material for measurement, and its association with industrialization explains why we use the blanket term "carbon" to speak about all the GHGs. The GWPs are based on laboratory analysis of the molecular structure of each type of molecule that determines its heat radiative behavior in the atmosphere. The main unit of measure we will deal with is a tonne of carbon. A thousand tons of carbon is a Megaton (Mt) and a 1000 Megatons is a Gigaton(Gt). We are told that a ton of carbon is about the size of an Olympic size swimming pool inflated with CO_2 gas. I surmise that as GHGs, the other CO_2 gases are proportional to this size based on their GWP. So, for example, a ton of methane as CO_2e is equivalent to 1/25 tons of CO_2, possibly the size of a Jacuzzi? Which, I guess, would mean that Sulfur hexafluoride, with a GWP of 22,800, would probably equate to a teaspoon. When we are discussing humans and organizations we usually use tons (or tonnes), discussions of regions (Cities, countries) are in units of Megatons, and Gigatons scale up to planetary dimensions.

It's a very cordial group of people as I later find out during tea breaks. We all vow that Eskom, the national electricity provider, is our mortal enemy and it's a unifying sentiment throughout the course; the feeling is punctuated by a few "load-shedding" electrical outages over the three days that further spark our wrath. As we go around the room and introduce ourselves it emerges that one of the major motivating factors for taking the course is pending tax legislation in the South African parliament. The tax has been proposed at R120 per tonne of CO_2e), the amount to be increased 10% per year. "The legislation has been postponed until 2016" the presenter tells us. "I don't think it will ever happen," says one of the attendees. "The economy of the country is already in bad shape, the tax will only make it worse" he continues. "Well, we are hearing that it will happen eventually, says the presenter." "It actually doesn't make sense to implement it with Eskom, since they have no competition they will just pass the cost on to the consumer…it won't make a difference in how they operate." "Yes, that is a concern" concedes the presenter, "But it should make a difference in the private sector as a brake on unnecessary emissions". I reflect on a past engagement with Eskom when I worked for a consulting company and witnessed the testosterone fueled in-fighting, backbiting and swagger of its mid and senior managers. The company had a strong engineering culture and was geared towards massive infrastructure rollouts. I recall, when I was working with them on a telecommunications project, that their latest feat of muscularity was the laying of fiber optic cables on existing electrical lines using helicopters. Eskom generates 45% of South Africa's CO_2 emissions and has a long political history tied to the development of the Apartheid state. The issue with Eskom highlights the bi-polar nature of the climate change issue in South Africa. I am sitting in a carbon analyst class

certified by the government through one of its SETAs (South African Education and Training Authority) with an expressed mission to lessen CO_2 emissions, yet the biggest emitter is the government itself, who is now proposing to tax itself into lowering emissions.

South Africa's position on climate change is laid out in the white paper entitled "National Climate Change Response". Drafted in 2011, it makes clear that the country's efforts to deal with climate change will not risk prospects of economic growth. The response paper explicitly outlines the two national response objectives. It reads ---

> South Africa will build the climate resilience of the country, its economy and its people and manage the transition to a climate-resilient, equitable and internationally competitive lower-carbon economy and society in a manner that simultaneously addresses South Africa's over-riding national priorities for sustainable development, job creation, improved public and environmental health, poverty eradication, and social equality. In this regard, South Africa will:
>
> - Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity.
>
> - Make a fair contribution to the global effort to stabilise GHG concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.[2]

In summary, the South Africa government says it will make an effort to ameliorate GHG generation, but not at the expense of its development plans. Changing the country's fossil-fuel coal dependency doesn't figure into the calculus of its climate change policy.

South Africa, like all other nation-states, has a primary concern with economic growth. The story of carbon is primarily the story of industrialization and every country has its own genealogy. South Africa's economy is resource-based with a history steeped in social tragedy and industrial triumph. The country's economic power is based on what Fine and Rustomjee (1996) call the "Minerals-Energy-Complex" (MEC). The author's argue that the South African economy is a historic anomaly constructed on post Boer-war competition between English capital and Afrikaner capital that led to state sponsor of industries in order to increase the share of wealth accumulation into Afrikaner hands. The resulting MEC is the basis for the core of accumulation in the country. During the Apartheid era the Afrikaner-based government owned the means of production of Steel (Iscor), Communications (Telkom), Chemicals and Fuels (Sasol), Transportation (Transnet) through these State Owned Enterprise (SOE). Many of the SOEs have been wholly and partially privatized, but Eskom remains in government hands, giving us the perverse situation where government is the biggest GHG generator in South Africa and also the regulator. The second and third biggest GHG polluters are SASOL and Arcelor-Mittal (Iscor's name after privatization and acquisition). Post-apartheid climate policy is further complicated by the high levels of poverty and unemployment, among the Black citizens traditionally excluded from enjoying the benefits of the MEC. This partially explains how I find myself in a wealthy

[2] (http://www.sanbi.org/sites/default/files/documents/documents/national-climate-change-response-white-paper.pdf)

suburb, in a Cape-Dutch architecture building, with a mixed race audience training for a "green economy" job, sanctioned by a government, in the process of building two new coal-fired power stations.

The MEC that industrialized South Africa was a result of a geological peculiarity. The largest gold deposits on the earth were found in the Witwatersrand goldfields. In a space of 100 years about 45,000 tons of gold (over 35% of the gold mined in the history of mankind) was extracted from the Witwatersrand Basin. Geologic science believes the basin was formed in a period of 360 million years in the Archaean age (Robb, 1995). Johannesburg is unusual because it is one of the few major cities not located on a water source (coast, river or lake). The company, Rand Water, is one of the largest and oldest water suppliers at 110 years old and provides an average of four billion litres of bulk potable water per day to more than 11 million people in an area that stretches over 18 000 km^2. The water is sourced from two major river basins the Orange and the Limpopo. In its early days, the city was plagued with dust as a result of its "Highveld" climate and also from the large mounds of mining waste around the city. Vast amounts of trees were planted, and over the years, Johannesburg has created the largest manmade forest in the world. (Turton, 2006). From 1886 to present, mankind has transformed a grassy highland, with little water, into a bustling industrialized area attracting people and finance from across the planet. Johannesburg is a powerful microcosmic representation of the ability of anthropogenic forces to reconfigure an environment.

George Simmel, in the essay "Metropolis and Mental life" (1903), says that cities shape the human personality into one that is necessarily calculative in order to deal with the constant assault different societal impressions present to the nervous system. Small town life is based on deeply rooted emotional connections, where city life, being the seat of the money economy, requires a higher intellectual form of consciousness. Johannesburg not only transformed the landscape it transformed the people, absorbing them into an ethos of capitalistic production.

Johannesburg, in some ways, is the precursor to the global Anthropocene. It is a 6009 km^2 space that has a distinct industrial history. In 1886 a farmer discovered a trace of gold on a reef that caused, in a few years, a total transformation of a part of the planet that had been largely untouched by man for geological epochs that spanned millions of years. It was not without issues. Working and living in Johannesburg was a perilous venture. It is estimated that 36,000 men were killed in accidents on the goldmines since the turn of the century (Reimer 231). Mankind's current surveillance of the Earth's exterior was predated by surveillance of its interior to understand tremors that caused fatal rockburst events in mines. Our current use of satellites in space to view the Earth's exterior was preceded by the use of seismographs underneath the ground. The Earth, in response to ruptures to her interior, also became a retaliatory actant and mankind was prompted to devise data intensive means to measure her transitory geological dispositions. Seismology, like climatology, also uses data and computer models to understand factors threatening human life. Johannesburg has a rich history of ecological surveillance aligned with its history of appropriation of the Earth's natural resources.

True to Simmel's observation, I soon become calculative and cognizant of our class's small contributions to Johannesburg's 26.2 MT of GHG emissions. Are we using energy efficient lightbulbs? Why is it necessary for some students to commute in such gas-guzzling cars --- Can we ride share? Are those pretty fountains powered by solar power? Where is our break and lunch food sourced? Locally? Or did it travel from far away places? As a result of immersion in carbon

knowledge, the world becomes surreal. A constant assault of numbers --- a Salvador Dali panoramic vision of melting digital carbon tonnage readouts associated with every ignition, flip of a switch and placement of a plug. Life in the city is a persistent observation of disbursements not only of capital, but also of carbon.

Calculations and Centers

Leaving the world of the biopolitical that is undergirded by a scientific understanding of climate change, the class moves into the domain of the particular. As a class we must start thinking about individual organizations calculating their carbon footprints. While we can argue that governments and scientists, with access to petabyes of accumulated knowledge are motivated by fear, we need to examine and understand the motivation of smaller GHG producing units. Certainly the idea of Earth as an actant trickles down into our individual consciousness, and to the organizations we represent and how lightly or heavily we tread in her domain. But most organizations make short-term decisions based on economic and social logic. The most pressing concerns voiced by the people in the class pertain to the proposed carbon tax legislation and it appears anecdotally that this type of class would not exist without the tax's coercive influence. The state has insinuated climate change fear into the economic realm and has gamed the system to force carbon-minimizing behaviors.

We are asked to discuss what we think contributes to calculations of carbon footprint.

"Electricity", "Water", "Fuel" are among the most obvious ideas thrown out. Our teacher tells us that carbon footprints can be calculated not only for organizations, but also for events, products and people. "Anything that is involved in generating a GHG has a carbon footprint" she tells us.. She enumerates the formal reasons that carbon footprints are calculated. They are:

1. To establish a baseline and carbon profile
2. To embark on an environmental efficiency programme
3. To understand potential carbon liabilities
4. To identify opportunities
5. To set targets and measure performance
6. To enhance an organization's brand

Carbon footprinting seems to intersect various philosophies of human motivations and calculus, simultaneously invoking visions of Homo economicus, Homo reciprocans and Homo Sociologious. Economic game theory uses these conflicting versions of human rational decision making to model economic behavior for particular situations. Calculations are not just the domain of scientists; every day behavior in response to climate change relies on a social calculus. The precision of these types of calculations are not as precise as those directly related to climate and carbon knowledge. Much depends on affect and aesthetics in calculations of actions --- and of the political climate of the time. In 2009 The Economist magazine ran a series on climate change. Their conclusion was ---

> It is all about politics. Climate change is the hardest political problem the world has ever had to deal with. It is a prisoner's dilemma, a free-rider problem and the tragedy of the commons all rolled into one. At issue is the difficulty of allocating the cost of collective action and trusting other parties to bear their share of the burden. At a city, state and national level, institutions that can resolve such problems have been built up over the centuries. But climate change has been a worldwide worry for only a couple of decades.

> Mankind has no framework for it. The UN is a useful talking shop, but it does not get much done.[3]

The Homo Economicus view of carbon footprinting is as an exercise in self interested profit maximization, In our modern world it means attracting resources, whether its financial capital or social capital to one's brand. In the 1960s, Ronald Coase, a renowned economist at the University of Chicago, came up with the idea of looking at pollution as a "property rights" issue. He published a paper "The Problem of Social Cost" (Coase, 1960) where he put forth the proposition that assigning clear property rights of emission to polluters and letting affected parties negotiate the production and reduction of emissions could produce more efficient results than a traditional "tax the polluter" principle. The idea was that the initial allocation of property rights didn't matter, and if the transaction costs were low enough, companies would negotiate the most optimal and efficient allocations. When applied to problems of the externalities caused by pollution, this meant that if government assigned pollution permits, the companies could trade these permits in such a way that they were efficiently allocated, with those companies needing to pollute acquiring more permits (and more costs) than those who pollute the least. Coase was a foundational thinker of the neoliberal movement and this approach to pollution typifies the philosophy; issues involving morality, justice and retribution, usually adjudicated by government intervention, are quantified and redefined as "externalities" and then engaged based on market principles. The South African carbon tax is based on these principles. In class we learn that in addition to the R120/tonne carbon tax, polluters can offset as much as 10% of their taxes by buying carbon credits. The intent is to create ways for South African society to "package" carbon reductions in such a way that polluters can purchase these reductions and reduce their tax burden…a "Pick and Pay" market for pollution!

The Homo Reciprocans take is that carbon foot printing is an exercise in benevolent "gift giving", in establishing a relationship of mutual reciprocity. It posits a stance of cooperation in order to improve the environment for themselves and others. From 19 to 22 April 2010, the 'World People's Conference on Climate Change and the Rights of Mother Earth' was held in Bolivia. The focus on the conference was giving grassroots/indigenous voices a platform to discuss climate change. It produced a Universal Declaration on the Rights of Mother Earth. It also formalized an initiative by Bolivian president Evo Morales, to declare Mother Earth day every 22nd of April to protect the rights of the Andean deity Pachamama (Mother Earth) and all beings who reside on her. A Homo Reciprocans definition of the "Rights of Mother Earth" came from the conference. It partly reads ---

> We, the peoples of Earth: gratefully acknowledging that Mother Earth gives us life, nourishes and teaches us and provides us with all that we need to live well; recognizing that Mother Earth is an indivisible community of diverse and interdependent beings with whom we share a common destiny and to whom we must relate in ways that benefit Mother Earth; acknowledging that by attempting to dominate and exploit Mother Earth and other beings, humans have caused severe destruction, degradation and disruption of the life-sustaining communities, processes and balances of Mother Earth which now threatens the wellbeing and existence of many beings; conscious that this destruction is also harmful to our inner wellbeing and is offensive to the many faiths, wisdom traditions and indigenous cultures for whom Mother Earth is sacred; acutely conscious of the

[3] http://www.economist.com/node/14994872

> critical importance and urgency of taking decisive, collective action to prevent humans causing climate change and other impacts on Mother Earth that threaten the wellbeing and survival of humans and other beings; accepting our responsibility to one another, future generations and Mother Earth to heal the damage caused by humans and to pass on to future generations values, traditions, and institutions that support the flourishing of Mother Earth.[4]

In its purest form, Homo Reciprocans is pretty much extinct. In class we discuss the concept of "carbon neutrality" which involves somehow offsetting every molecule of carbon generated by an activity that absorbs carbon. Given that every time we switch on a light switch in South Africa and most industrialized nations, we are instantly connected to distant lump of smoldering coal, it is hard to imagine anyone but the most disciplined off-gridding, tree-planting, organic gardening, cave dwelling person achieving reciprocans status --- In the modern world total reciprocity is only possible in communities who haven't overleveraged "fire"…A trip to the Karoo to find to a Khoi/San community living a pre-colonial lifestyle might result in a Homo Reciprocans sighting. But carbon neutrality is a near impossible goal for our commodity producing, combustion engine loving, coal-fired world, that is resistant to ubiquitous renewable energy. The best we can do at the moment is ameliorate…Homo Amelioratus?

Homo Sociologious are entities who simply follow prevailing social norms without regard to self-interest or rules of reciprocity. These are people who are "socially constructed" and form the basis for anthropological understanding. The "early adopters" of understanding climate change are scientists themselves. 97% of scientists acknowledge that climate change is a reality and is due to human activity.[5] The slow penetration of the ramifications of climate data is making simple, but profound changes on the ways people conduct their every day lives. "Green" is not just an emblematic color, but also a call to action to live and work in more ecologically friendly ways. We see in western economies more emphasis on fuel-efficient vehicles, recycling, energy saving building techniques, solar and wind power, etc. Social norms are changing in recognition of the challenge posed by climate change. Society is facing the economic issue of "the tragedy of the commons" on a worldwide scale. A google on the Internet reveals that there are numerous voluntary carbon footprint calculators where you can input lifestyle information and get a score along with recommendation on ways to improve. One of the discussions we have in class is of NGOs involved in climate activism always doing something to counteract the increase in their organization's carbon footprint when they use an airplane to go on a conference. Showing up in a community of ecologists just having logged a long international flight that pumped large amounts of GHG into the atmosphere is considered the height of hypocrisy. Maintaining social purity is the goal of Homo Sociologious. As society increasingly becomes ecologically conscious, it is not hard to imagine a future where an individual's carbon footprint is of equal symbolic importance as their credit score as an indication of social acceptability.

Looking around at my fellow students in the Carbon Analyst course, I would classify all the participants as Homo Economicus. In the era of the Anthropocene I think the other two hominids exist, but because of the nature of this event (paying customers), we are all hoping to reap some future economic benefit out of the time spent. The person in the class with the most urgent concerns is the student from AVIS. The car rental business is expecting to experience major

[4] https://pwccc.wordpress.com/programa/
[5] http://climate.nasa.gov/scientific-consensus/

financial impacts because of the carbon tax, as will any other organization that manages a large fleet of vehicles. The student from EXXARO mines also is anticipating impacts because of the power generation requirements and heavy machinery it uses in extracting minerals. The student I meet who seems to have the least direct economic motivations is a lady from DaVinci Hotel. The hotel is looking at ways at making its hotel more ecologically friendly. They are looking at ways to use less electricity and consume fewer resources. They are embracing the slogan "reduce, reuse, recycle" to generate less waste. Their motivations are seemingly noble, but also related to the economic rationality of pleasing an ecologically minded clientele. These types of social calculations circulate in society and animate human actions surrounding issues of climate change as much as the scientific calculations.

The class instructor tells us that there are three global best practices for calculating carbon footprints.

Greenhouse Gas Protocol
The Greenhouse Gas Protocol developed as a partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD. Input from environmental NGOs and Industry leaders resulted in the first standard being published in 2001. It is the most widely used carbon foot printing standard.

International Standards Organization 14064
The International Standards Organizations 14064 specification is based on the GHG Protocol and was launched in 2006. Unlike the GHG Project Protocol, which has specific guidelines on what tools and accounting methods to use, ISO 14064 gives guidance on what to do but does not spell out the exact requirements.

Publicly Available Specification (PAS) 2050
This standard was developed by the British Standards Institute in 2008 and was revised in 2011. It specifically relates the carbon lifecycle to goods and services.

Latour would call these standards an exercise in Metrology. Metrology is a way to tame the world outside a laboratory so that when information is brought inside the facts and figures can survive (Latour, 1987). In the past, explorers journeyed to far away places and logged information using pen and paper and battled rain, heat, snow and other forces of nature and happenstance that prevented reception of the data at a center of calculation. Today we use an instrument or laptop to make a measurement and wirelessly transmit the data to its reception center instantly. We are to use the GHG Protocol standard and in doing so we will discipline our measurements so that they are comprehensible to other people using the same methodology, connecting the local and the global. The Anthropocene necessitates multiple semiotic undertakings. Carbon Equivalence (CO_2e) is the unit of measure that abstracts the molecular properties of the 7 GHGs into a single idea useable by society to calculate carbon footprints. CO_2e is also a way to assign responsibility for climate change through calculation and circulation of knowledge. Our class is most concerned about gases, because they are the basis of calculations of carbon footprints, but there are other sources of data (temperature, sea-level recordings, and glacial ice) that gives us further background in order to explain to skeptical clients, colleagues and students the need to do the footprint calculations. All of these measurements are used by modern climatologists in larger meteorological exercises.

In Paul Edwards book *"A Vast Machin*e", which gives a historical account of meteorological science, its is clear that, historically, weather was an early facilitating force that erased any concern of national boundaries in a quest for knowledge for a common good. Men and women responsible for collecting, "cleaning" and archiving data are held in high esteem (Edwards). One of the first of the data collectors was Matthew Maury, a US naval officer. In 1853 he organized the first intergovernmental conference in attempt to standardize weather-observing data. It was held in Brussels and attended by nine European nations and the United States. The conference succeeded in establishing a standard logbook format and instructions for taking maritime weather measurements.

Maury's efforts evolved into what became the International Meteorological Organization (IMO). The first meeting was held in 1873 in Vienna. Thirty-two representatives of twenty countries met for two weeks. Their most pressing concern was for consistent standards so that information could be shared. There was a focus on "calibration and checking of instruments, hours of observation, scales and units, and the mutual exchange of information by telegraph. The first attempt at unified collection of data from field sites was from a project called the Reseau Mondial. It was the brainchild of a French meteorologist Leon Teisserenc de Bort, who wanted to collect daily data via telegraph from a set of representing the entire world. The network consisted of 500 land stations, not covering the ocean. Today, we take for granted the frictionless exchange of information over large distances. The Reseau Mondial project proved extremely complex because there was still disagreement on standards between nations, limits on communications, and the fact that most data exchange took place by mail. Postal communications meant that it could take months for data to arrive from distant locations. As a result, the first annual data for 1911 was not published until 1917, with the added disruption of World War, it wasn't until the 1960's that the World Meteorological Organization (WMO) the IMO's successor, successfully implemented the World Weather Watch, which allowed near-real-time collection and observation of data.

Over the years, different strains of meteorology competed for legitimization of their methods. There were the forecasters, who were primarily concerned with making daily prognostications quickly. Their methods relied on heavily on synoptic charts and geographical isolines as visualization techniques. There were also the theoretical meteorologists who sought to understand weather deductively through theories rooted in fluid dynamics, gas physics and other basic sciences. And then there were the empiricists who worked to understand weather behavior from data measurements. They relied on close analysis of observations through statistical methods. The empiricists were the predecessors of today's climatologists who now deploy analytical methods as a primary technique for understanding climate as a systemic phenomena spread over a long time period.

Today's climatologists work primarily with Global Climate Models (GCM) that simulate the world's climate systems. The myriad of inputs required to accurately mimic the Earth's complex system to make a predictive model, is mind-boggling. ----

The entire climate system involves the interaction of the biota, air, sea, ice and land, with solar radiation providing the energy that drives it. Variations of gaseous and particulate constituents of the atmosphere, along with changes in the Earth's position relative to the Sun, vary the amount and distribution of sunlight received The temperatures of the oceans has a marked influence on the heating and moisture content of the atmosphere. The unreflected radiant energy drives the

atmospheric circulation of the oceans. The atmosphere and oceans are both influenced by the extent and thickness of the ice covering the land and sea as well as by the shape and composition of the land surface itself. Since each of these components has a different range of response times, the whole system evolves continuously, with some parts lagging or leading other parts. (Trenberth)

Simulation allows scientist to work on climate change in a laboratory; complex climate simulations are only possible in a few laboratories around the world with the computing power and data storage capacity to handle the processing necessary to generate a digital facsimile of the atmospheric contingencies of the planet earth. These laboratories include the U.S. Department of Energy's (DoE) Oak Ridge National Laboratory (ORNL), the National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluid Dynamics Laboratory (GFDL), the National Center for Atmospheric Research (NCAR) and the National Aeronautics and Space Administration (NASA), the UK's Meteorological Office (MetOffice), Korea Meteorological Administration (KMA), Brazilian National Institute for Space Research (INPE) and Center for Weather Forecasts and Climate Studies (CPTEC), Danish Meteorological Institute (DMI), the U.S. Naval Oceanographic Office (NAVO), Meteo Swiss and the Finnish Meteorological Institute (FMI). The computer purchased by the UK's MetOffice in 2014 is described as having the capacity to deliver --- 16 petaflops or 16,000 trillion calculations per second; has 480,000 processing cores, equivalent to 100,000 Playstation 4s; will weigh 140 tonnes, equivalent to 11 double decker buses; has 2 billion gigabytes of working memory, equivalent to that found in 120,000 smartphones; and 17 billion gigabytes of storage, which is enough to store 3.5 years worth of high definition movies.[6]

Paul Edward says --- "If you can simulate the climate, you can do experiments. God-like, you can move the continents, make the sun flare up or dim, add or subtract greenhouses gases, or fill the stratosphere with dust. You can cook the Earth, or freeze it, and nobody will even complain. Then you can watch and see what happens." (Edwards, 2010)

Latour describes the laboratory as a place of power. He says, "it is in laboratories that most new sources of power are generated" *(*Latour, 1983). He argues that laboratories are inherently political in that they allow leveraging of knowledge for the renewal of society and politics.

"Give us laboratories and we will make possible the Great War without infection, we will open tropical countries to colonization, we will make France's army healthy, we will increase the number and strength of her inhabitants, we will create new industries." (Latour, 1983: p 159)

Latour says that inscription plays a vital role in the power generated within a laboratory by making things scientists talk about easily readable. Matthew Maury's standardization of weather observing data allowed weather data to be talked about and discussed in a consistent language and created a community of people who could share information. A sheet of data may just look like a scramble of numbers, but those numbers represent internationally agreed methods, scales and proportions. It is a description of a place and time interpretable by others clued in to the code. Computer models are the ultimate in data complexity and inscription; they are representative of

[6] . (http://www.reportingclimatescience.com/news-stories/article/new-cray-supercomputer-for-uk-met-office.html)

the cumulative human knowledge of climate. Models not only allow interaction between scientists, but also enable prediction and possibly even prescription. They give scientists a crystal ball to see into the future, exalting the laboratory to a place where visions of the future are generated and evaluated. An apocalypse will not be an unforeseen event. It will first appear on a digital monitor inside a laboratory.

Carbon footprinting and its many motivations for calculations are creating data as immutable mobiles; but to travel where? In South Africa, if motivated by legislation, they will go to the state. The city is also a receiving point. We shall see if subsequent chapters that there are international NGOs and United Nations bodies that are interested in carbon measurements. As isolated measurements, a carbon footprint provides the basis for limited actions by individuals or companies. But when the data travels to a central point it can lead to action on a grand and unified scale. These various places that the data is collected and consolidated are what Latour calls “Centers of Calculations”, the new Versailles that allow a center to “dominate at a distance”. The “cycles of accumulation” at a center are what leads to scientific knowledge, a “Copernician Revolution” of sorts. Once in a “Center of Calculation”, carbon footprints move away from empiricism, and the mind plays a role in shaping knowledge. Scientific enquiry can investigate factors related to the carbon budget as “what if” exercises with spreadsheets, or with highly sophisticated computer simulations.

Cultural Brokerage

After deciding on using the GHG Protocol Standard as the basis of our footprinting calculations, the class forges ahead to discuss the next necessary steps to conduct a carbon footprint within an organization. We must convene a meeting with all the stakeholders in our organization and conduct a workshop. The objectives of the workshop are:

- Get Organizational buy-in
- Meet all the key project stakeholders
- Learn about the organizational structure
- Define the reporting period
- Assign roles and responsibilities
- Set project timelines

Our class leader emphasizes that unless the organization is committed to supporting the process, rarely is a carbon footprinting exercise successful. The hardest part of footprinting is actually obtaining the data. The people involved must look through files, obtain old billing statements, find out specifications for equipment they use and engage in a number of tedious activities that are not part of their normal job routines. The usefulness of knowledge depends on its effective circulation. So we, as carbon analysts, also act in the capacity of cultural brokers. We must convince people that this is a worthwhile exercise. We must also establish relationships with senior management in order to have the social capital to maneuver within the organization. One movement that I've interacted with that acts as a cultural broker on a worldwide basis is Al Gore's Climate Reality Project.

Al Gore's Climate Reality project held a 3 day event in Johannesburg and also collaborated with Food and Trees for Africa (FTFA) to establish a permanent presence in the city. I unfortunately was informed of this two days before the event was to take place. All of my calls to contacts to try to officially get signed up for the event came to naught. So I took the bold move of just showing up at the Sandton Convention Centre and sneaking into the venue. With the official binder for the event, obtain in the foyer, clasped to my chest, the guards didn't notice that there was no registration ID card hanging from my neck. I was in! Waiting to see Al Gore, the father of the climate change movement, in person. There are 900 people at the conference. We are grouped into round tables, seating about 10 to a table. The people at my table don't seem to know each other, but other tables have groups from the same organization. The program is eclectic with presenters that are poets, politicians, NGO heads, and Media specialists. My favorite presentation is by Danai Gurira, who is an actress and playwright. She uses her storytelling skills to talk about her childhood in Zimbabwe and the changes in the climate landscape she notices through the years.

The intent of the conference is to create "Climate Leaders", people who can effectively communicate the challenges of climate change within the communities they live in. We are given access to a climate leaders portal where presentations are available for download. We are encouraged to track our "acts of leadership". Examples of these are delivering a climate reality presentation, writing a letter for a news outlet, meeting with local, state or national leaders, writing a blog post and conducting a radio or media interview. The conference really does not

focus on solutions, its more about raising awareness of the implications of climate change. Al Gore presents periodically throughout the conference. He is hailed as the elder statesmen of the movement. It is difficult to make climate change an exciting topic and the man who could have been the leader of the free world is not particularly successful in animating the topic. But his presence brings a certain gravitas to the event and the imperative of addressing the crisis. The next stop for the project is Australia, where the group plans to train hundreds more climate leaders.

If we are indeed entering a new Anthropocenic era, then the role of cultural broker is to facilitate translation new knowledge to people still steeped in outdated beliefs; We, cultural brokers, must act as a bridge between cultures. In this case, we are trying to translate to the population of the entire planet knowledge and beliefs of a new epoch. In the Anthropocene, nation-states and their citizens, must acquiesce to the ecological demands of the earth. This is the role of Al Gore's Climate Leaders. The role of cultural broker was first expressed in Clifford Geertz's work The Javanese Kijaji: The Changing role of a Cultural Broker where he looked at the role of the Islamic scholars (Kijaji's) in bridging the divide between the lives of rural villagers and political elites of the metropolitan areas of Indonesia. The term is also used in the healthcare field, and is defined as "the act of bridging, linking, or mediating between groups or persons of differing cultural backgrounds for the purpose of reducing conflict or producing change (Jezewski, 1990).

As cultural brokers in the area of climate change, we are equipped with white papers, videos, power-point presentations and PDF files of facts and figures. These are secondary inscription devices that incorporate data into forms palatable to the masses. Our aim is to bridge the divide between climate change as a scientific fact into the societal domain where action is possible. Given the invisible materiality and the unperceivable temporality of the phenomena it is difficult to establish climate change as a clear and present danger. Passionate pleas for change are only effective in the realm of established facts; without facts there is a risk of accusations of fear-mongering, exaggeration and hyperbole.

Latour says ---

> Before meteorology became a science, they say, everyone was fumbling in the dark, spreading half-truths about the shape of clouds or the flight of sparrows, believing in all sorts of absurd myths mixed up, fortunately, with a few very sound practical recipes. A more charitable interpretation is that they could not get the whole picture and reacted only to local and provisional signs. We now get on the one hand **beliefs** about the weather, and on the other, **knowledge** of this weather. (Latour, 1987: p 182)

The problem of conveying scientific knowledge is illustrated by an interaction between two US senators. The first senator, Jim Inhofe, from the state of Oklahoma, appeared on the floor of the senate after a very heavy snowstorm in Washington, DC. The senator produced a snowball as proof that all talk of a warming climate was hokum. This was clearly a weather event that has nothing to do with climate. But on the Senate floor he stated ----

> "In case we have forgotten, because we keep hearing that 2014 has been the warmest year on record, I ask the chair, you know what this is? It's a snowball. And that's just from outside here. So it's very, very cold out"

The rebuttal came from Senator Sheldon Whitehouse, a senator from Rhode Island. ---

> "You can believe NASA and you can believe what their satellites measure on the planet, or you can believe the Senator with the snowball. The United States Navy takes this very seriously, to the point where Admiral Locklear who is the head of the Pacific Command, has said that climate change is the biggest threat that we face in the Pacific…you can either believe the United States Navy or you can believe the Senator with the snowball…every major American scientific society has put itself on record, many of them a decade ago, that climate change is deadly real. They measure it, they see it, they know why it happens. The predictions correlate with what we see as they increasingly come true. And the fundamental principles, that it is derived from carbon pollution, which comes from burning fossil fuels, are beyond legitimate dispute…so you can believe every single major American scientific society, or you can believe the Senator with the snowball."



The presentation of a snowball scooped up from outside the USA senate chambers to some may be convincing proof that the world is not warming. To others it invites accusations of irrationality. Sure, it indicates that there is a winter season and the atmosphere is capable of cooling to the point of generating snow, at least in Washington DC. But could the senator bring the snowball to Versailles as evidence of worldwide climate change? Not! The snowball is neither mobile nor immutable.

Latour describes scientists as being in a network that is dedicated to the creation of facts. He describes a perceived asymmetrical relationship between those between "people who hold more or less distorted views of things" (Latour, 1987) and "people who *know* the truth of the matter". But, Latour argues that accusations of irrationality are unfounded and based in misunderstandings of cultural beliefs that have their own logic. He says that under closer examination charges of irrationality are generally dismissible because "just because you do not share the beliefs of someone you should not make the additional supposition that he or she is more gullible than you". Inhofe's beliefs are based on religion. "I take my religion seriously." Inhofe writes in his book on climate change entitled "The Greatest Hoax." "This is what a lot of alarmists forget. God is still up there and He promised to maintain the seasons and that cold and heat would never cease as long as the earth remains." (Inhofe, 2012: p 68)

A person following their cultural beliefs is actually the norm and is not unusual. What is very strange is that "only a few thousand people succeed in displacing billions of opinions". How

scientists succeed in this endeavor, is what Latour describes as a socially constructed process of "fact creation".

He says --- "Between scientists and chaos, there is nothing but a wall of archives, labels, protocol books, figures and papers". (Latour, 1986) and that "Keeping track is the only way of seeing a pattern emerge out of disorder."

Latour puts forth a counter-intuitive argument that scientific texts, and I will add, data, are extremely social. More social than popular literature and other familiar forms of inscription. Why? Because they are dependent on allegiances for their credibility. Allegiances are built up, in the case of texts, through footnotes, citations, references to prior work and other associations. In the case of data, allegiances are built through impartial instruments, corroboration, and consistency.

Latour explains ---

> "The adjective "scientific' is not attributed to isolated texts that are able to oppose the opinion of the multitude by virtue of some mysterious faculty. A document becomes scientific when its claims stop being isolated and when the number of people engaged in publishing it are many and explicitly indicated in the text. When reading it, it's in on the contrary the reader who becomes isolated. The careful marking of the allies' presence is the first sign that the controversy is now heated enough to generate technical documents." (Latour, 1987: p33)

TerraFirma arms us with a number of videos to convey the urgency of climate change.These include a story of an Australian piggery that uses methane capture technology to become carbon neutral, a video explanation of how coal is converted to energy and causes GHGs, a movie on the economic impact of the USA's hurricane Sandy which was considered an extreme weather event, a video of the omnipresent Al Gore explaining how GHGs make the earth warm, A video on Walmart 's Supplier Energy Efficient Project (SEEP) where Walmart lent its engineers into its supply chain to help identify ways to lessen energy use. These aren't scientific texts or data, but they have those as supporting allies. Our job as climate change cultural brokers is to get people in the non-scientific community to view these videos, presentations and documents and become **isolated** by the allegiances implied by their content and production. We, along with Al Gore's Climate Reality brigade, are trying to subtlety bully them by an overwhelming show of intellectual force into "saying yes" to solving the climate crisis.

After the Carbon Footprint Workshop our participants should have the knowledge to go through their organizations and organize the collection of data. The will have defined the "financial" and "operational" boundaries of the process for the company and they will also know how to differentiate between Scope 1, Scope 2 and Scope 3 emissions. The financial and operation information is important because a company may have total operational control of a subsidiary, although it only owns, lets say, a 50% equity stake in the company. So a decision would have to be made as to whether to do the carbon footprint base on what it controls operationally or its financial stakes.

Scope 1 are direct emissions within the company, these include diesel generators, emissions from a vehicle fleet, emissions from smelting operations, and "fugitive" emissions from machines.

Scope 2 emissions are indirect emissions from a utility that generates electricity or steam for operations. These are from Eskom

Scope 3 emissions are other indirect emissions that are a consequence of activities of a company, but occur at sources not owned or controlled by the company. These could include extraction and production of raw materials the company uses, business travel, disposal of wastes.

It is mandatory to report on Scope 1 and 2 emissions. The categories are set-up this way to ensure that there is no double counting of emissions among companies doing the reporting. Scope 3 emissions are optionally reported. The data sources for reporting require sleuthing around in records including utility bills, metering systems, fuel use logs, odometers, fuel bills, invoices, travel agent records, expense claims and in some instances doing employee surveys. This is an inscription process that is tedious and mundane. But once its done the company will have a basic idea of where it generates the most GHGs and what areas to look at for improvement. The carbon footprint itself involves taking this data (called activity data) and calculating the total GHG emission using the formula:

GHG emissions = Activity Data x Emissions Factor

GHG emissions are measured in tonnes of CO_2e. The emissions factors for each type of activity data are derived from a database. The one we use is from The Department of Environment, Food and Rural Affairs (DEFRA) a UK organization. The DEFRA database covers:

- Fuel conversion factors
- Process emissions
- Passenger transport
- Freight transport
- Refrigeration and air conditioners
- Material Use; and
- Waste

The database is on an Excel spreadsheet that we load on our computers. It is empirical data, sanitized, synthesized and canned for footprinting exercises. So the way it works is you look at all the data you collected and calculate the GHG emission in tonnes of carbon. For example you are a mining company and you use 12000 litres of diesel in your onsite generators every year, you would find the tab for generators in the DEFRA spreadsheet. The emission factor for diesel generators is 2.6691 $kgCO_2e$/litre. So 12000 litres x 2.6691 $kgCO_2e$/litre = 32,029 kg CO_2e or 32.03 tonnes of CO_2e . Voila! A paper exercise has revealed and inscribed an ecological infraction perpetrated against mother earth.

AFRICA INDUSTRIES CARBON FOOTPRINT ASSESSMENT

			TONNES CO_2e			
Scope	**Emission Source**	**Category**	**Africa Industries**	**Namibia Warehousing**	**Swazi Design**	**Total**
Scope 1	Diesel Generators	Stationary Combustion	2,5	6,94	158	71
	R134a Split Units	Fugitive Emissions	7	-	6,26	10
	Distribution	Mobile Combustion	-	237	-	189
	Company Owned Vehicles - Employees		-	-	39	15
	Company Owned Vehicles - General		6,32	-	-	6
	Forklifts		-	57	-	46
TOTAL SCOPE 1			**16**	**301**	**203**	**338**
Scope 2	Electricity		205	260	-	413
TOTAL SCOPE 2			**205**	**260**	**-**	**413**
TOTAL SCOPE 1 & 2			**222**	**560**	**203**	**751**
Scope 3	Paper		14,81	12,02	1,05	25
	Water		22	44	-	57
	Waste		0,55	0,46	0,41	1
	Employee Commute		28	205	-	191
	Business Travel - Car Hire		2,68	2,91	1,27	6
	Business Travel - Flights		196	21	10	217
TOTAL SCOPE 3			**263**	**285**	**12**	**496**
TOTAL CARBON FOOTPRINT			**485**	**845**	**215**	**1 247**
Intensities		per employee - all scopes	37,32	8,05	8,96	
		per R'million - all scopes	5,92	13,85	10,24	
		per employee - scope 1 & 2	17	5	8	
		per R'million - scope 1 & 2	3	9	10	

NOTES:				
	Number of Employees	13	105	24
	Annual Turnover (R'Mill)	R 82	R 61	R 21

Here is a completed Carbon footprint calculation from the workshop for a company called African Industries who has subsidiaries Namibia Warehouse (80% owned) and Swazi design (40% owned). African Industries carbon footprint is 1247 tonnes of carbon a year. If this company were to look at areas to reduce their footprint they would probably start in the Namibia warehouse subsidiary with their fleet used for product distribution and also employee commutes at the same location. Business travel at the African Industries parent company is also high.

Included in the calculations are "intensities" so it is possible to see how much carbon is generated per employee and in relation to earnings. These figures allow for comparisons to different companies.

These sets of calculations along with the supporting verbiage is the culmination of our carbon footprinting exercise. This is the kind of inscription we now have the skill to produce. It is somewhat scientific, but it lacks citations and references. It is what people in the Information Technology field call a dataset. Datasets are not very exciting objects; yet they are the powerful inscriptions that allow scientists and technologists to describe the outside world.

The concept of dataset is widely used and is generally agreed to have four features: grouping, content, relatedness, purpose. (Renear, 2010). Grouping meaning it's a collection of some kind. Content relates to the fact that it contains something like values, observations, and descriptions. Relatedness has to do with data related by time, place, instrument, or object of observation. Purpose -- They are clearly created in order to contribute in some way to scientific activity. Maury's early efforts at putting together datasets were ship logbooks, now datasets are collected in iphones, motor vehicles, social media apps, satellites and much more. Our African Industries dataset is a confession of a company's contribution to the proliferation of GHGs. It groups the various kinds of infractions; it contains observations from around the company that are all related to a particular year long period.

We have completed the training to become Carbon Analysts. Like Al Gore's Climate Reality Core, we can go out and present information to the uninformed, not only on climate change, but

also on ways to measure it. We will facilitate the production of increasing numbers of datasets. The people who are interested in making this a new career or to extend current consulting offerings to include carbon footprinting, exchange cards and plan to stay in touch. Students who are working for companies that have large GHG emissions are pleased that their skills are updated and they are prepared for dealing with issues related to the carbon tax if the government decides to implement it. The teacher of the class gives us instructions on the "Proof of Evidence" we need to submit in order to receive our official certification. We are issued a certificate of attendance to document the fact that we did partake in the training, although we still need to prove our proficiency with the new knowledge. There are a myriad of new career opportunities in the era of the Anthropocene ---- alternate energy specialists, organic farming, ecologists, ecotourism operator, green building architect are some just to name a few. The massive potential negative impacts of the Anthropocene have the potential to transform economies. In the aftermath of World War II, the world created the Bretton Woods organizations that established the dollar as the premier reserve currency, and regulated monetary policy through the World Bank and IMF. Under the threat of the Anthropocene new ways of "treading lightly" in the world are generating new "Green" oriented organizations and individuals focused on managing GHGs. The key word is "sustainability". The United States Environmental Protection Agency says ---

> "Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations."

Sustainability is about survival. Although the class participants entered the training as Homo Economicus, the long-term trend is that the Anthropocene will make actions of "sustainability" normative and within the realm of the "taken for granted". It has already started ---Cars are more fuel-efficient; solar powered devices are becoming cheaper and more available; Airlines include GHG emissions information on their tickets. In South Africa it was decided that giving shoppers plastic bags to hold their newly purchased goods was unsustainable. The problem is explained ---

> South Africans consume approximately 8 billion plastic carrier bags annually. The carrier bags in question are the thin-filmed plastic bags. They are free of charge and not recyclable. In reality, their cost generally is built into the product cost. Due to the extensive use of these bags, an acute solid waste problem has ensued. With most of these bags littering the streets, they have become known as the country's national flower. Plastic bags create litter due to their lightweight and their tendency to balloon with the wind. The problem is further exacerbated in developing countries like South Africa, where the bags tend to be blown by wind at land disposal sites due to open dumping. The impact of this litter is magnified by the persistence of the material in the environment and its ability to harm animals, particularly marine, wild animals and livestock. In particular, there are concerns with regard to the impact of plastic-bag usage on resource consumption and litter. (Dikgang)

The imposition of a "bag-levy" has completely normalized the practice of bringing a carrier bag on shopping outings in order to carry new purchases. What would have been considered an odd activity only undertaken by self-righteous zealots on the ecological extreme is now welcomed and expected. There are now a wide variety of carrier bag designs to choose from and shoppers

don't mind bagging their own groceries into their own containers. We may see a future where some items are sold in "bulk" with no packaging at all. The consumer will bring his/her own re-useable container to buy certain products. Government policies may be the prime impetus for the behavioral changes in the Anthropocene, as we can see bag-levies, fuel-efficiency standards, building codes and other policies have already made a major impact.

These efforts at sustainability, creating Homo Sociologious who unconsciously adheres to new ecological social norms like the bag levy, augurs a future where mankind will consciously and unconsciously acknowledge the Earth as an actant with powers of sovereignty. The change will probably come in a number of different ways, but people acting and trained as cultural brokers is one engagement model that works for Climate Reality and Carbon Footprinting. Simple acts of hygiene, like washing hands before handling food or eating a meal, at one time weren't normal everyday practices. But armed with scientific evidence of the disease inducing power of invisible microbes, people's ablution habits changed. Government intervention in the form of cleanliness standards for restaurants, and cultural brokers in the form of sanitation officials presenting scientifically produced data isolated people into succumbing to new regulations. In time, given the success of various forms of cultural brokerage, the general public will likely become more conscious of activities that generate invisible, atmospheric polluting carbon molecules Evolution to Homo Sapien Sapien (the wise one) is a work in progress.

Commodification

During the carbon footprinting class, the instructor mentioned that as part of the carbon tax legislation, companies can, optionally, use carbon-offsets to report lowered emissions and avoid paying taxes. Terra Firma offers a course called "Carbon Projects and Markets" that provides information on how carbon-offsetting works. I find out later that there are no planned future classes because of lack of interest. My guess is the interest level will rise if/when the legislation is in place. But it's a reminder that some international carbon offset projects are already in place in South Africa.

I recall another encounter with carbon facilitated through Food and Trees for Africa, the NGO that represents the Climate Reality initiative. In 2010 they got involved in a project to plant bamboo in order to earn carbon credits. Carbon Credits are bought and sold all over the world. Sometimes the transactions are private affairs between two entities, but there are also carbon trading markets similar to a stock market, where public transactions are performed. As an investigation into carbon markets I took a trip with Mary Ferela, a FTFA project manager, to the site of a bamboo plantation in a peri-urban community on the outskirts of Johannesburg.

"We are planning to plant 100 hectares" of bamboo says Mary. We are in the process now of delivering the seedlings to the community". "We worked with C4 Ecosolutions, a climate change consultancy organization, to select the best variety of bamboo for the climate we have here. So we have chosen a clumping bamboo called Bambusa balcooa for the project. It is a "clumping" type of bamboo, which means it doesn't have a rampant spreading pattern like "running" bamboo, which is considered invasive in some situations.". Although its not indigenous to South Africa, this variety of bamboo has naturalized to local conditions and is considered very hardy and easy to grow. Some background research shows that bamboo plantations sequester carbon in orders of magnitude greater than forestry plantations (Widenoja), making it an innovative choice for carbon credit projects.

As we drive into the community at Lawley on the south side of Johannesburg, near Orange Farm. On the way we pass small homesteads, some are formal brick structures others are rickety shacks made of aluminum siding. This is not a rich community and is typical of many of the township areas surrounding Johannesburg. The roads are mostly paved, but turn to dirt as we approach the area designated for bamboo. The plantation is a large field on a sloping hill. There is a greenhouse structure staked off and made of an opaque plastic covering. I see a tractor and a few hand farm implements as we get out of the car and go to meet the people gathered there.

Mary introduces me to Rev Mohapi Kopano who is the leader of the project. There are a few other men with him and they are discussing the work for the day. A group of about 5 women approach with shovels and hoes in preparation for the day's tasks.

"We are very excited about the bamboo project" says Rev Kopano. "We are looking forward to harvesting it in a few years and starting some manufacturing projects". "What do you plan on doing with it --- the harvested bamboo?" I ask. "We are thinking of using it to make "roof tiles" says the reverend. I know that bamboo is used extensively in Asia. Houses, tools, scaffolding, furniture are all made of bamboo. You see it everywhere when travelling the region. It would be great if it could obtain the same ubiquitous status in Africa, I think.

We take a look at the bamboo seedlings that are housed in the greenhouse. In order to make the project more sustainable, the bamboo is to be planted with other food crops in the field. Its estimated that it will take the bamboo 3-4 years to mature and at that point the carbon credits can be claimed by Food and Trees for Africa or their funders.

How much carbon does bamboo sequester I ask Mary. "About 1,7 tonnes/plant over a plant's lifetime "she says. "We are planning to plant 100 hectares in each of two communities. And a hectare can contain 230 plants." The lifetime of a plant is 7 years. But claims for credits can be made after year 3. The price of the carbon credits we earn depend on the market price at that time we sell." A little math shows that the city of Joburg's carbon output could be offset by around 67,000 hectares of bamboo, a plantation the size of the Marakele National Park in Limpopo.

Carbon Trading is a product of neoliberal ideas of free markets and individual choice. It falls under the jurisdiction of the United Nation's Clean Development Mechanism (CDM). The Kyoto Protocol, established in 1997, and put into force in 2005, was the process that marked the beginning of the worldwide engagement with issues of climate change. It was also the foundation of carbon's emergence as an economic entity. In the trading world, one ton of carbon (or equivalence) taken out of the environment is called a Certified Emission Reduction (CER). As a commodity, carbon has an omnipresent materiality. All other commodities have an ever-present problem of transport --- How do you get oil, coffee and coal from one place to another. How is it officially transferred from one owner to another as part of a transaction? Carbon is all around us --- waiting to be commoditized and enclosed within an imaginary CER unit only made visible on paper and screens as numbers extracted from calculations on spreadsheets. CERs have no physical allure like gold, it doesn't have a following of connoisseurs like tea, it doesn't have geographical confinements like sugar or fraught geopolitical histories like oil. Unlike any of the top tradeable commodities (e.g. oil, coffee, natural gas, silver, sugar, corn, wheat, cotton) CERs have no aesthetic, culinary, energy, or sartorial value. Its trading history isn't traceable to fulfillment of fundamental human desires for comfort, pleasure or wealth. There will probably never be a scarcity of raw materials for its production. The complexity of its production within an approved and recognized project is the only factor in its scarcity value. In fact, it has no real "use" value for an individual human being. Although possible, it's hard to imagine a hoarding of CERs. Unlike gold, the sites for mining have no physical limitations other than those imposed by politics.

The Marxian M-C-M' (Marx, 1996) circuit has been manipulated for the altruistic purpose of sequestering carbon. Money chasing commodities to make more money is the engine that runs the capitalistic system. Latour sees money as another form *of* "immutable mobile necessary if one place is to exercise power over many other places far apart in space and time" (Latour, 1983: p 28). Latour, asserts that "money becomes useful when it is combined with all the other inscription devices". He says, "The different points of the world become really transported in a manageable form to a single place which then becomes a center" (Latour, 1983: P 29). CERs are abstractions of money that are combined with carbon inscriptions.

CERs also represent Carbon that could have been in the environment that isn't. If its taken out, like with the bamboo project, the CER is generated from a Carbon "sink". If it's not put into the environment, like a hydro-electrical station that could have been a coal-fired station, the CER is from an "offset". A CER as a commodity, represents not only the carbon taken out of the atmosphere, but also the capital and labor that went into the effort.

Before the third COP conference in Kyoto, the US government began to design a carbon-trading proposal, announcing in 1996 that this kind of 'flexibility' would be 'the key requirement' for accepting binding targets. Flexibility is a keyword --- it implies maneuverability, adaptability and non-constraint. Then US Vice President, Al Gore, was a key proponent of carbon trading. What was initially a facility called the Clean Development Fund, for developed nations to provide direct finance to developing nations, became the Clean Development Mechanism, which housed carbon-trading and other market-based solutions to climate change. The Clean Development Mechanism allowed the industrialized countries to buy carbon credits from developing countries in order to meet their reduction targets. Although designed by the US, the Bush administration opted out of participating in the Kyoto agreements and accepting binding emission reduction targets. Other countries, particularly in Western Europe and parts of Asia, are the main Kyoto implementers. The target market for FTFA bamboo is not local. The buyers of the carbon credits will be in western countries that, through the Clean Development Mechanism, can offset their carbon pollution with CERs from developing countries. CERs are immutable mobiles that use carbon to link the developing world with the developed world.

The famous statement by Lawrence Summers when he was the chief economist of the World Bank ----"I believe the economic logic behind dumping a load of toxic waste on the lowest-wage country is impeccable and we should face up to that." does not seem to have rung collective alarm bells in the Global South that something afoul is afoot. Rob Nixon outlines an argument for "slow violence" being perpetrated against the poor in developing nations (Nixon, 2011). However, the hegemonic power of the neoliberal discourse appears to have advanced carbon trading as a positive economic development for the Global South, facilitating technology transfer and job creation. Ignoring the obvious ethical and moral problems of Summer's statement, a spreadsheet comparison of employing labor from the North or labor from the South for GHG reductions, would undoubtedly show that southern GHG labor, like southern sweatshop labor exploited by poverty, weak government protections and social vulnerability, creates more profits because of lower wage demands and therefore makes CERs more marketable.

Neoliberalism has commoditized carbon because of its collective threat. So unlike scientific empirical and analytical approaches involved in surveillance of the planet, the commoditization of carbon offers mankind the opportunity to co-opt the global economic trade system to work to solve climate change issues. European legal theory understood the right of property as the control over things as contrasted to sovereignty, which was the rule over people (Mitchell, 70). CERs are the property of individuals with ownership rights constantly mediated with the help of various agents, with the various carbon "stock" markets as Latourian "Centers of Calculations". Homo-Economicus is thus employed to enter the climate change fray and with profit maximizing efficiency help rid the planet of GHGs.

Mitchell (2002) in Rule of Experts argues that the concept of "economy" itself was born out of a change in forms of sovereignty. He says that economy "appeared in the context of the collapse of an imperial order". It was the erosion of the British Empire and the rise of nation-states in former colonies that forced an effort to figure out "How to conceptualize, measure and manage the circulation of money within a defined geographical space" (Mitchell, 2002)

He says----

> "The development of economies provided the forms and formulas through which European colonial powers could attempt to restructure the relationship with their colonies in the mid-twentieth century, and through which imperial powers whose reach was still expanding in particular the United States, could find a new mode of operation". (Mitchell, 2002: p 84)

Instead of science we are now in the realm of finance. Lohmann (2011) envisions a scenario where carbon-trading has the same destabilizing effect on financial markets as derivative trading.

> "Like the new derivatives, carbon commodities work through a process of radical disembedding – in this case, disembedding the climate issue from the historical question of how to organize for structural, long-term change capable of keeping remaining fossil fuels in the ground. Ominously, however, the valuation paradoxes that afflict climate commodities are even more intractable than those that affect complex financial derivatives, to say nothing of more familiar commodities like ordinary futures or food, energy, and consumer durables." (Lohmann, 2011: p 90)

So carbon, like derivatives, could require the talents of the "quants" on Wall Street to measure factors like risk, price stability, and demand --- factors that have nothing to do with the actual commodity, but everything to do with the market system the commodity is embedded in. CERs are new forms of immutable mobiles, created in conjunction with carbon budget realities they share with other data representations, an extension of power that is traditionally directed towards people, to a power that is directed over space. Mitchell argues that one of the first ways a declining empire exerted power over its former or soon-to-be former colonies was through mapping. Accurate mapping using methods of triangulation allowed for space to be visualized and then make information about the space (population, ownership, geographic features, etc) to compliment the map itself. Mitchell says, "mapping played a role in producing the distinction between land as "mere object" and the abstractions of law, taxation and title". So the map was an instrumental tool that allowed the layering of a topography of production, exchange, ownership on top of a spatial representation of a particular geography. It was now possible to locate the most fertile lands, see what was growing there, understand who owned the land, and who should be taxed. And through time it was possible to keep up with the changes and create a spatial history. It also empowered "centers of calculations". The site of control could be moved from the field to the office. Maps were the precursor to the computer models now used by national climate agencies. They were paper representations that allowed power of control and calculation to move from the field to an office and even offshore to a colonial metropole; on this point, Latour and Mitchell are aligned.

In tandem with the emergence of the map was the increased importance of statistical information. Mitchell's example of what happened in the case of British controlled Egypt is extensible to other geographies. In 1898, the National Bank of Egypt was granted the right to issue banknotes. There was a gold reserve requirement to cover half of the notes in circulation. Earliest understanding of "economies" was the measurement of movement of money, specifically banknotes. The Egyptian Ministry of Finance started keeping statistical records of credits and circulations as well as the gold reserves and other deposits within the bank. Egypt's primary export commodity was cotton, which was exported largely to Europe. There were powerful financial institutions in Europe entwined within the Egyptian agriculture and banking system that demanded cadastral surveys and productions of other forms of statistical information so they could exert control at a distance,

not as imperialists, but as “investors”. This is the scenario that Mitchell argues gave birth to new practices of inscription, description, and enumeration forming new methods of calculability. It is a similar situation creating CERs in the era of the Anthropocene and allows control of distant bamboo fields in the carbon trading markets in the world’s large modern metropoles.

FTFA is innovative in the use of bamboo as a way to earn carbon credits. Most projects consist of schemes like hydro-electrical plants, landfills and forestry plantations. The ways to commodify carbon into a tradable unit abound! Marx defines a commodity as "an object outside us, a thing that by its properties satisfies human want of some sort or another." The gaseous substance CO_2, in and of itself, is not a commodity, but political processes have transformed it in one. And as an immutable mobile it has become a powerful vehicle for “domination at a distance”. Indeed, capital can travel to far-flung reaches of the earth and "flexibility" has allowed the problem of carbon pollution to disconnect itself from the pollution source. Industrial polluters can use CERs to offset their CO^2 emissions from anyone in the world that has the facilities to sequester/sink or offset carbon. It’s a bit ironic that carbon can become a commodity/immutable mobile in the Marxian M-C-M’ circuit, and owners of capital can use it to offset their emissions, since it was Western industrial emissions that played a great part in creating the Anthropocene in the first place. As we can see with Lawley’s bamboo plantation, the power of inscription has effectively moved some of the responsibility for staying within the carbon budget to the Global South.

Coordination

My continuing quest to encounter carbon finds me again at Food and Trees for Africa. Civil society and NGOs in South Africa gather together at their offices in Wendywood at an event organized by Climate Reality to discuss South Africa's input into the Paris process. The nation-states of the world are putting their carbon reduction plans together and headed on the "Road to Paris". The Congress of Parties (COP) 21 is to be held in Paris, France in December 2015 is prompting South Africa and other nations to ready their climate change submission in the form of a document called an Intended Nationally Determined Contribution (INDC). Not liking to drive at night, I am tempted to take up Uber's offer to provide transportation to the even at a reduced cost; but a friend and I attend in my car. We are greeted at the entrance to FTFA's grounds, and check in as RSVPed guests. I pick up a voucher, after paying R50 for a "Road to Paris" T-shirt. The crowd looks like a cross section of the Green Johannesburg community, mostly White and young. FTFA has set up a tent on its lawn with seating for the 50- 70 guests in attendance. The program is to consist of a panel discussion with Jeunesse Park, the head of Climate Reality – South Africa, Bantu Holimisa, a member of parliament, former deputy minister for environmental affairs and member of the United Democratic Front, Maesela Kekana, from the Department of Environmental Affairs and Michael O'Brien-Onyeka the CEO of GreenPeace Africa.

Spirits and soft drinks are available while we wait for the event to begin. Later we are offered organic soups made from vegetables taken from FTFA's garden. Before the main event a theatre group called The Hlabelela Ensemble, gives a highly energized performance on climate change. They call this form of entertainment "Edudance".

"I am the Earth, I am dying" implores one of the performers. "If you don't help me now I will burn you and all your generations with your own ashes". Global Warming, Climate Change and Permaculture are the topics we are going to cover. One of the performers ask the audience "who can tell me what is global warming" Heating of the planet! CO_2! An expected raising of temperature!" are answers from the audience. Yes! says the dancer. Global warming can change rainfall patterns, sea levels are going to rise, and will cause a change in plants, humans and wildlife. But today we are going to teach you Educance. In Edudance we talk less and move more! Are you ready to see us move?

What follows is an animated, choreographed, dramatization of the plight of the planet and what humanity can do about it. I see that this is an effective and creative way to communicate to people without making them read and digest dry statistics and data. Science presented as a performance.

Introductions of the panelists are made, and Jeunesse Park's introduction reiterates conclusion of climate science…

> "We have to act now. There is no more time. Science is telling us everyday that the 2 degrees we are hoping to cap the temperature rise to is not feasible anymore. In fact, South African science is telling us that we are headed more towards 6 degrees. This makes not only South Africa, but the whole planet unlivable. So our road to Paris is to really draw attention to the importance of this meeting. This will be the 21st meeting of

> world leaders and if a strong equitable decision is not taken this year, we are all in serious trouble".

Bantu Holimisa starts the discussion with a remembrance ----

> In 1965, I was a headboy of note. I was 10 years old then. I used to take my home's and animals to graze lands. I could hear the noise and sound of the birds at the time. The rivers and rivulets were full of water. And if I would take you back to my area today it is a complete change altogether. The rivers are silty, there are no birds at all, you don't hear anything. The agricultural fields are lying there fallow. Meaning that the levels of poverty have increased tremendously. In fact, Mr. Mandela in one of his visits to the villages of the Transkei. asked me, What happened to the noise of the birds we used to listen to? I said "Dadi" because of poverty, the people of have chopped down their trees and those species have migrated."

Holimisa goes on to talk about the need for the proceeds from the Carbon Tax to be ring-fenced, and applied to problems related to climate change. He also laments that government departments work in silos when it comes to issues of the environment.

Kekana from the Department of Environmental Affairs says ---

> I participate in the negotiations that we will conclude in Paris. We have been working for the last 4 years. Failure is not an option. We will have a Lima-Paris action agenda that provides business with a platform. There is also a platform for local government -- mayors can showcase their activities. There will be a lot of activities outside the negotiations. It is not just talk. There will be agreements. The presidency will be there in the beginning.

The most provocative member of the panel is the CEO from GreenPeace.

> I am privileged and honored to be among these two dinosaurs, in a positive way. We face a challenge in the NGO sector, especially an organization like GreenPeace. On the one hand we want to present the full picture, but at the same time we want to give hope. In Africa we are looking at a massive increase in population in the next 15 to 30 years --- that is in our lifetime. Population will increase from 1.2 billion to over 2 billion by 2040/2050. There will be about 10 countries accounting for 2.4 billion people; these countries are like Nigeria, Ethiopia, DRC. These countries are struggling with food security and job creation every day. The demographic allocation will jump from 50% youth to 75% young people with 75% of the population squeezed into urban spaces. So we aren't looking at mega cities, we will be looking at mega slums. UNICEF has come up with detailed research called Generation Africa 2030. You should take a look at it. It will scare the living daylights out of you! Incremental changes will not do it. 600 million new babies will be born in this continent between now and 2030 that's in 15 years. 300 million in Nigeria alone. That is the current population of the United States to put it in scale. We are going to dump the United States into Nigeria in 15 years. South Africa will have 40 million new babies in 15 years. Now we don't have the educational facilities, medical facilities to manage now. Now we talk about COP. We need transformational change. I look at the INDC. It is dangerously weak. They call it a FAB document---Fair, Ambitions

and Balanced. We say we are looking at a FLAB document --- Full of lies, ambiguities and bullshit. We need a huge transformation from a carbon heavy, to a carbon neutral, economy by 2040 or maximum 2050.

The INDC becomes the focus of further discussions. It is the document that represents South Africa's commitment to the global community on its contribution to the carbon challenge. The hypocrisy of the building of new coal-fired energy plants is highlighted along with a pending water shortage that may cause "water-shedding" in the country. The CEO from GreenPeace, expands the dialogue to include issues of population growth and water. He calls on 'the trinity" of state, private sector and organized civil society to join forces to come up with innovative proposals. Kekana highlights that the Africa group of negotiators is coming up with a continent-wide renewable energy plan that will be presented to heads of states. He also emphasizes that everyone, as consumers, has a responsibility and must be mindful of their carbon footprint. Holomisa, talks about his foundation that has planted thousands of trees in rural areas. "As poor as we are, we will go down in history as making efforts to solve the problem" he says.

The INDC is available online along with input from interested parties. There is commentary from Cosatu, Contralesa, University of Cape Town, The World Wildlife Fund, The South African Waste Picker's Association, South African Faith Communities along with GreenPeace and others. The time frame the INDC considers is between 2025 -2030 in which years it says carbon emissions will peak in the range of 398 to 614 Mt CO_2e. The fuzziness of the time frame and emission numbers is the basis for the accusations of ambiguity from GreenPeace. Other commenters' lament that South Africa won't be considered a credible negotiator without more specificity. UCT says that the South African position is "inadequate" in supporting the worldwide goal of limiting global warming to 2 degrees. The WWF proposed a scenario from 2016-2050 in which there is a global carbon budget of 1000GT. If RSA's target emissions peak at the 614MT level, it would use about 1.97% of the global carbon budget, a number out of proportion to South Africa's population.

COP21 in Paris will probably be considered a success, if the cumulative INDCs from all the countries add up to less than the carbon budget for a designated timeframe. Paris is the Center of calculation for carbon and climate change. The INDCs are self-diagnostic reports that comprise the cumulative climate change panoptic planetary inquest. Data is being brought to Versailles (or close by). All of the immutable mobiles will descend on the City of Lights in order for the planet to take a good look at its future prospects of habitability.

What's happening here with the divestment movement, carbon footprinting and COP21's INDCs, is a truth and reconciliation (TRC) process. The analogy is not perfect, but there are many similarities to consider. Societies

Carbon Trust Labels and Descriptions

The **Reducing CO2 Label** can improve your brand's reputation by clearly communicating your carbon reduction commitment and achievements.
Our most popular labeling offer allows you to see the Reducing CO2 Label, on and off products, to communicate your carbon reduction commitment and achievements to your customers.



The **CO2 Measured Label** allows to you show that you have accurately measured the footprint and communicate the carbon footprint. No commitment to reduce the products' carbon footprint can be made using the CO2 Measured Label.



have rituals of rebellion, as observed by Max Gluckman in his study of the Swazi Incwala ceremony (Gluckman, 1964), which ritualized opposition to a king's rulership. In our present age of the Anthropocene are we engaging in rituals of reconciliation with the same goal of renewing the social system by publicly and openly expressing societal conflicts? The national and industrial carbon confession processes, like the Truth Commission, following the fall of Apartheid in South Africa, signal a change. New laws are in place for a new regime. Perpetrators of crimes must be re-integrated into moral communities. New symbols are created. Crimes of the ancien regime must be acknowledged, forgiven and redressed where appropriate. James Gibson says --- Sharing responsibility, blame and victimhood creates a common identity, which can provide a basis for dialogue. If people are no longer dogmatically attached to a "good versus evil" view of the struggle, then perhaps a space for reconciliation is opened (Gibson, 2006). Participating in carbon footprinting helps form new communities and identifies companies engaged in the process as ecologically concerned. The success of such processes is widely hailed. It has the unintended consequence of creating a friendly discourse about the past and everyone's complicity in the "crimes". New inscriptions were created and archived. Truth and reconciliation as a transitional justice process converted what could have been an era marked by thoughts and actions of retributive justice into one that smoothly moved to structures for a new type of sovereignty. James Gibson further says ---

"Led by Desmond Tutu and fully supported by Nelson Mandela, the process certainly generated a great deal of information if not truth (including a seven-volume report), and talk of reconciliation filled the public discourse since the time when the commission was created. Although some South African commentators are less sanguine, many observers throughout the world subscribe to the view that the truth process did indeed contribute to reconciliation in South Africa and that reconciliation has been a crucial factor in moving the country toward a more democratic future" (Gibson, 2006)

After completing a carbon footprint measurement process a company can "move up" in the carbon world by joining other communities of practice. The Johannesburg Stock Exchange has a Socially Responsibility Investment Index (SRI). This local initiative requires disclosure of carbon emissions as a prerequisite to listing on the index. Internationally, there is a very active movement called the Carbon Disclosure Project (CDP). It's an NGO that describes itself as "working to drive greenhouse gas emissions reduction and sustainable water-use by business and cities". This is where the action is on global carbon measurements by companies. Companies are motivated to do carbon disclosures via CDP because it is a source that investors most often use when researching a companies environmental standing. Flipping through their website you see banners announcing ---Now available: Global Data from the Global 400 companies --- Including disclosure and performance scores, Cities Data is Now Open ---GHG emissions, climate risks and emissions reduction activities for over 100 Major Global cities, International Day of the Forests---Explore Forest Risks and Assessment Data from Companies Reporting to the CDP since 2013. The CDP is achieving what would be difficult for governments without the messy machinations of politics--- getting organizations to adhere to high standards of behavior for GHG emissions. As an NGO they don't have the any punitive powers to ensure enforcement, what they offer organizations is a form of social capital for being included in their databases. Submitting to the rigors of measurement increases a company's status and makes for positive news to include in official documents and reports aimed at present and future stakeholders. The "anti-political" thrust of the CDP project has resulted in the largest central repository of company based climate

change data in the world. The datasets aren't only open to investors, but also to academics and other organizations that may want to run some sort of analysis on the information.

The "invisibility" of climate change, not only in the GHGs that harm the atmosphere, but also the almost imperceptible changes that it brings to our human lives, necessitates a means to make it visible. Once visible, then decisions and judgments are possible. Humanity can decide, in a Durkheimian manner, what totem to associate with and belong to. Data and information about climate change needs to be transformed into perceptible images. Data makes for lousy symbols, but it can form the basis upon which symbols are constructed. In the era of the Anthropocene some broad classifications are apparent. ---- Green, Organic, Ecologically conscious are but a few that people and organizations apply to themselves. Data allows the refining of these monikers to more precisely identify those that are involved in addressing the challenges of climate change. The Carbon Disclosure Project maintains a climate performance leadership index. This is a group of companies identified as putting forth extraordinary efforts to battle climate change. It represents the high priests of the industrialized world's moral ecological community. These companies attract the money of ecologically conscious investors, their methods for reducing GHG emissions are researched and replicated, and their products are exalted above their competitors for their "clean" production methodologies. The visual symbolism is sometimes opaque and is more evident in the company that they keep than in outward logos or branding.

Another carbon "ratings agency" company named Carbon Trust is more involved in the production of outward symbols of climate change cooperation. Carbon Trust is similar to the Carbon Disclosure Project in that they are involved in the measurement of GHGs. They are more involved in individual engagement with climates rather than CDP's mission of aggregating data. With proper participation and affirmation that a company is committed to reducing its GHGs, Carbon Trust offers a few different labeling options for organizations to use to enhance the brand appeal of their company, services and products. A company can say that its Carbon is measured or is being reduced (See sidebar). The reducing CO_2 label requires that a company publicly communicate its carbon footprint status; it doesn't require that the company commit to reduction of the footprint. The reducing CO_2 label requires that there has been a recertification over a two-year period showing a reduction in GHG emissions. These labels provide people with a visual cue to the company's consciousness in the realm of climate change. We can see the work of the data and datasets produced by carbon measurement and their contribution to modern inscription. The human foot is an appropriate symbol indicating human migration to all corners of the world that is now trampling on sensitive ecosystems. It also shows the part of the body that connects us most continuously to the earth; and is consistently the dirtiest part of our anatomy. In some cultures, people show their disapproval of someone by attacking them with shoes --- For example the act of throwing shoes shows extreme disrespect in the Arab culture. At a press conference in Baghdad, in the aftermath of the Iraqi Invasion a journalist threw his shoes at then US president George Bush yelling "This is a farewell kiss from the Iraqi people, you dog". In India there was a well-publicized beating of men who had attempted to rape women in a village. The men were tied up, stripped and then the women of the village set upon them and continually assaulted them with shoes. Indeed the Indian caste system associates the lowest of the four castes, the Shudra, with the feet of the creator, the foot being the being the lowest and most ignoble part of the human frame (Abdedekar, 2014). So given the somewhat universal understanding that the foot area is a site of filth and disrespectability, a footprint evokes the appropriate emotions associated with polluting GHGs. We should expect more of these labeling schemes, giving collective representations and symbolic materiality, to appear as we proceed further into the Anthropocene.

Derrida (1996), in Archive Fever, says consignation "aims to coordinate a single corpus, in a system of synchrony in which all the elements articulate the unity of an ideal configuration." (Derrida). Archives in the form of INDCs, NGO databases, rating agency indicators, country/city rankings, are being established worldwide. Because there are standardized measurement methods and methodologies, the data is assessable for an infinite variety of uses and analysis even though it exists in multiple places. Although there is not a single archive of climate related data, the ubiquity and speed of access of the Internet obliterates the need for a central, physical repository. Latourian "Centers of Calculation" occupy numerous geographies in cyberspace The climate archive, in the form of digital information, is vast and generally made public and freely available. Archontic power, says Derrida "gathers the function of unification, of identification and of classification." The power of the climate change archive is apparent in its ability for mankind to make build collective representations of the who, what, and where of GHG emissions. South Africa, like other countries is producing this knowledge and participating in global reporting. The Road to Paris and COP 21 will soon conclude a worldwide effort to stay within the carbon budget and avoid giving Earth further reason for exasperation and retribution. This is carbon knowledge that not only allows for "domination at a distance" but also allows for synchronous action on a global scale.

Conclusion

The research looked at processes involved in the creation of new inscriptions based on the recognition of an earth-wide carbon budget. Carbon footprints are the most ubiquitous of these new types of inscriptions; produceable, based on established knowledge of what types of movement and forces contribute to GHG production, they only rely on activity data from spreadsheets. In laboratories, climate models provide information on the general status of all of earth's interconnected hydrological, atmospheric and biological functions. Empirical satellite data gives information on temperature, ocean levels and glacial ice. Market-based carbon credits assign costs for offsetting or sinking carbon. The research looked at all of these as different ways of seeing carbon. We've seen carbon in the city, in scientific centres and calculations, in processes of commodification, in acts of cultural brokerage and in efforts to coordinate responses to climate change. No doubt, there are many other ways of seeing carbon, but these few encounters highlight the reality that the visibility of climate change is based on data; data is further theorized as an "immutable mobile". The immutability of data in the 21st century is primarily based on the reliability of instrumentation and the ability to digitally copy and reproduce findings. In the past, paper was the prime medium of immutability, but today, in addition to paper, there are many electronic receptacles for human inscriptions. The mobility of data allows its transfer across space and through time. The advent of digital communications ensures light-speed mobility and allows connection to numerous "centers of calculation". It is in these centers of calculation where the work of biopolitics takes place ---the power of "making live" and "letting die". The South African context of the research is important and shows that there are many different ways, depending on economic, political, industrial and historical contexts, to exercise biopolitical power in response to climate change. This paper began with the assertion that the Anthropocene marked a radical departure from mankind's formerly amicable relationship with planet earth. Our relationship is now adversarial and, given the power of the earth to "take life" and "let live", humans are living under a new form of sovereignty with earth as the temperamental monarch. The new forms of inscription have the purpose of surveiling the earth and measuring the grievances inflicted upon her, with the idea of assigning accountability and making improvements and amends where possible. There is an emerging scientific, economic and social panopticon that is seeing the earth through carbon optics and creating reimagined carceral existences.

Governments, like South Africa, are implementing carbon tax and carbon credit programs to incent businesses to lower their GHG emissions. That is not to say there are not loftier motivations in the wider world, but in this study we have mostly encountered Homo Economicus. Our observations have noted that people either want to make money or save money by way of participating in the green economy. Earth's threatening posture is yet to change our "habitus". The changes so far are from economic coercion and not ecological conviction. And it's primarily prompted through the scientific community, who are understandably, the first responders to a threat with slow and mostly imperceptible reverberations. The responses of those trying to make money, involve participating in the process of carbon commodification. CERs are a new form of currency available to those able to deploy labor and capital in efforts to capture carbon molecules and prevent their creation. The looming South African carbon tax has spurred organizations to lower their emissions so as not to effect bottom-line profitability. The Carbon Tax

implementation in South Africa as a carbon reduction mechanism is in direct conflict with the government's project of building two new coal-fired electricity production facilities, which illustrates the sometimes performative nature of state sponsored GHG reduction initiatives. Nation-states all over the world find themselves in the biopolitical quagmire of advocating economic growth policies to provide productive livelihoods for their citizens, but at the same time needing to act as good global citizens and living within the global carbon budget. The "making of life" has become a tragedy of the commons with conflicts between the local and the global. Given that all human life is considered equal, and "freedom" in the 21st century is dependent on the ability to participate in GHG producing activities (heating/cooling, cooking, motorized travel, consumption of goods and commodities, etc) the calculus of climate change is reducible to a simple equation.

Freedom = Carbon Budget / Global Population

The resulting number, the carbon per person allocation, indicates the constraints an individual would need to live within in order to forestall catastrophe. For many, this definition of freedom may not resonate as an appropriate measure. In the South African climate of post-coloniality, society is confronting dire issues of inequality, poverty, racism and other injustices left in the wake of Apartheid. #RhodesMustFall but #GlobalTemperaturesRise are not aligned. Economic growth, job creation, wealth creation and prospects for "a better life" are all inextricably connected to carbon emissions --- not only in South Africa, but also around the world. Freedom, in the epoch of The Anthropocence, is not a simple linear equation, but a complex social conundrum. There are no easy solutions. Mankind can ideally engage in an ahistorical discourse of climate solidarity --- assuming equal au courant moral and ecological responsibility across the globe for carbon emissions. Efforts at creating a climate panopticon create wider awareness and a higher level of sapience of climate issues. NASA's *Earth Now* app is an example of an initiative to communicate carbon knowledge to a wider audience. With a tablet, anyone can see the current status of Earth's ecological system as reported by three different satellites driven by real time data. Weather apps have proliferated for years, but this new app reports from outer space, surveiling the planet and informing earthlings of climate impacts. Viewing this app, we see no national boundaries; just color-coded indications of where there are abnormal or normal climate conditions. As South Africa continues to warm at twice the rate of the rest of the globe (Scholes, 2015), perhaps local, data driven, real time inscriptions will appear. Walter Benjamin's explanation of the law-preserving and law-making functions of violence provides insight into the requirement to make radical changes in the era of the Anthropocene where the Earth, herself, is a new sovereign. However, **divine** violence, Benjamin says, is law-destroying. The loss of the ability to imagine and caricaturize the earth in anthropomorphous tropes will mark the end of the Anthropocene and entry into a more anarchic epoch. At present, the calculability of climate change knowledge and its circulation through massive collections and archives of data allows translation and interpretation into new inscriptions and symbolic representations that mankind can act on. Society will further engage in the biopolitical, not only to "make life" but also to "preserve" life.

References

Agrawal, Arun. *Environmentality: Technologies of Government and the Making of Subjects*. Durham: Duke University Press, 2005.

Ambedkar, B. R., and Arundhati Roy. *Annihilation of Caste: The Annotated Critical Edition*. Edited by S. Anand. Ant Cri edition. London: Verso, 2014.

Appadurai, Arjun, and Ethnohistory Workshop, Symposium on the Relationship between Commodities and Culture Ethnohistory Workshop, eds. *The Social Life of Things: Commodities in Cultural Perspective*. Cambridge [Cambridgeshire]; New York: Cambridge University Press, 1986.

Beavon, Keith Sidney Orrock. *Johannesburg: The Making and Shaping of the City*. University of South Africa Press, 2004.

Benjamin, Walter. "Critique of Violence," Selected Writings, Cambridge: Harvard University Press 1996.

Blok, Anders. Mapping the Super-Whale: Towards a Mobile Ethnography of Situated Globalities. Mobilities, 5:4, 507-528. 2010

Bond, P, R Dada and G Erion (eds) (2007) Climate Change, Carbon Trading and Civil Society: Negative Returns on South African Investments. Amsterdam, Rozenberg Publishers, and Pietermaritzburg, University of KwaZulu-Natal Press

Coase, Ronald Harry. *The Problem of Social Cost*. Bobbs-Merrill Company, College Division, 1960.

Crutzen, P.J. "Geology of Mankind" and "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature"?, Ambio vol. 36 no 8,2007

Derrida, Jacques. *Archive Fever: a Freudian Impression*. Religion and Postmodernism. Chicago: University of Chicago Press, 1996.

Dikgang,Johane et al, Analysis of the Plastic Bag Levy in South Africa. Cape Town, RSA. University of Cape Town

Durkheim, Emile. *The Elementary Forms Of The Religious Life: A Study In Religious Sociology*. London: Allen & Unwin, 1915.

Edwards, Paul N. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. The MIT Press, 2010.

Ferguson, James. *The Anti-politics Machine: "Development," Depoliticization, and Bureaucratic Power in Lesotho*. Cape Town: David Philip, 1990.

Fine, Ben, and Zavareh Rustomjee. *The Political Economy of South Africa: From Minerals-energy Complex to Industrialisation*. Johannesburg: Witwatersrand University Press, 1996.

Floater, Graham, Rode, Philipp, Robert, Alexis, Kennedy, Chris, Hoornweg, Dan, Slavcheva, Roxana and Godfrey, Nick, (2014),Cities and the New Climate Economy: the transformative role of global urban growth, LSE Research Online Documents on Economics, London School of Economics and Political Science, LSE Library.

Foucault, Michel. *Discipline and Punish: The Birth of the Prison*. New York: Vintage Books, 1979.

Foucault, Michel, François Ewald, Alessandro Fontana, and Arnold I. Davidson. *Security, Territory, Population: Lectures at the Collège de France 1977--1978*. Edited by Michel Senellart. Translated by Graham Burchell. 1 edition. New York: Picador, 2009.

Foucault, Michel. *"Society Must Be Defended": Lectures at the Collège de France, 1975-1976*. Translated by David Macey. Reprint edition. New York: Picador, 2003.

Geertz, Clifford. "The Javanese Kijaji: The Changing Role of a Cultural Broker." *Compstudsocihist Comparative Studies in Society and History* 2, no. 2 (1960): 228–49.

Gevisser, Mark. and Sarah Nuttall. "From the Ruins: The Constitution Hill Project." *Public Culture* 16.3 (2004): 507-519. *Project MUSE*.

Gibson, James L. "The Contributions of Truth to Reconciliation: Lessons from South Africa." *The Journal of Conflict Resolution* 50, no. 3 (June 1, 2006): 409–32.

Gluckman, Max. Rituals of Rebellion in South-East Africa.. (The Frazer Lecture, 1952). Manchester: Manchester University Press, 1954

Gornitz, Vivien. *Rising Seas: Past, Present, Future*. New York: Columbia University Press, 2013.

Gore, Albert, Davis Guggenheim, Laurie David, Lawrence Bender, Scott Z. Burns, Jeff Skoll, Leslie Chilcott, et al. *An Inconvenient Truth*. Videorecording. Paramount, 2006.

Hansen, J., M. Sato, P. Kharecha, D. Beerling, R. Berner, V. Masson-Delmotte, M. Pagani, M. Raymo, D. L. Royer, and J. C. Zachos. "Target Atmospheric CO2: Where Should Humanity Aim?" *The Open Atmospheric Science Journal* 2, no. 1 (November 5, 2008): 217–31. doi:10.2174/1874282300802010217.

Hamilton, Carolyn, Verne Harris, Michèle Pickover, Graeme Reid, Razia Saleh, and Jane Taylor. *Refiguring the Archive*. Springer Science & Business Media, 2012.
Heidegger, M. (1977) The Question Concerning Technology, in:The Question Concerning Technology and Other Essays, W. Lovitt (trans.) (New York, Harper and Row), pp. 3– 35.
Hobbes, Thomas, and A. D. Lindsay. *Leviathan*. London: J.m. Dent, 1914.
Inhofe, James M. *The Greatest Hoax: How the Global Warming Conspiracy Threatens Your Future*. Washington, D.C.: WND Books, 2012.
Jezewski, M. A. (1990, August). Culture brokering in migrant farm worker health care. Western Journal of Nursing Research, 12(4), 497–513.
Latour, Bruno, and Steve Woolgar. *Laboratory Life: The Construction of Scientific Facts*. Edited by Jonas Salk. Reprint edition. Princeton, N.J: Princeton University Press, 1986.
Latour, Bruno. *Reassembling the Social: An Introduction to Actor-network-theory*. Clarendon Lectures in Management Studies. Oxford ; New York: Oxford University Press, 2005.
Latour, Bruno. *Science In Action: How To Follow Scientists And Engineers Through Society*. Cambridge, Mass: Harvard University Press, 1987.
Latour, Burno. In K. Knorr et M. Mulkay (editors) Science Observed, Sage, 1983, pp.141-170 [New edition slightly abridged in Mario Biagioli (editor) Science Studies Reader, London Routledge, 1999]
Latour, Bruno. (1994) "On Technical Mediation – Philosophy, Sociology, Genealogy". Common Knowledge, 3(2), 29-64
Latour, B. (1983). *Visualization and cognition: Drawing things together* (pp. 1–33). Boston, MA: Harvard University.
Lohmann, Larry. "Marketing and Making Carbon Dumps: Commodification, Calculation and Counterfactuals in Climate Change Mitigation." *Science as Culture* 14, no. 3 (2005): 203–35. doi:10.1080/09505430500216783.
Lohman, L. (2011). Financialization, Commodification, and Carbon: The Contradictions Neoliberal Climate Policy. *Socialist Register*, 48, 85-107
Marx, Karl. *Das Kapital: A Critique of Political Economy*. Regnery Gateway, 1996.
Mauss, Marcel. *The Gift*. London: Cohen & West, 1954.
Miller, Daniel, ed. *Materiality*. Durham, N.C: Duke University Press Books, 2005.
Mitchell, Timothy. "Carbon Democracy." *Economy and Society* 38, no. 3 (2009): 399–432.
Mitchell, Timothy. *Rule of Experts: Egypt, Techno-politics, Modernity*. Berkeley: University of California Press, 2002.
Nixon, Rob. 2011. *Slow Violence and the Environmentalism of the Poor*. Cambridge, Mass.: Harvard University Press.
Renear, Allen H. et al. Definitions of Dataset in the Scientific and Technical Literature.Champagne Illimois. Cemtre for Informatics Research in Science and Scholarship.2010
Robb, L.J. et al. "*The Witwatersrand Basin, South Africa: Geological Framework and Mineralization Process".* Ore Geology Reviews 10, 1995.
Rousseau, Jean-Jacques. *The Social Contract.* Trans. Maurice Cranston. Harmondsworth, England: Penguin Books, 1968.
Schäffler, Alexis, and Mark Swilling. "Valuing Green Infrastructure in an Urban Environment Under Pressure — The Johannesburg Case." *Ecological Economics*, Sustainable Urbanisation: A resilient future, 86 (February 2013): 246–57. doi:10.1016/j.ecolecon.2012.05.008.
Schmitt, Carl. *The Concept of the Political: Expanded Edition*. University of Chicago Press, 2008.
Scholes, Bob et al. Climate Change: Briefings from Southern Africa. Wits University Press, 2015.
Simmel, George. *Metropolis & Mental Life*. University of Chicago Press, 1903.
Trenberth, Kevin E. Climate System Modeling http://stephenschneider.stanford.edu/Publications/PDF_Papers/TrenberthSm.pdf
Turton, A. et al. "Gold, Scorched Earth and Water: The Hydropolitics of Johannesburg". International Journal of Water Resources Development vol. 22 2, 2006
Widenoja, R. 2007. Sub-optimal equilibriums in the carbon forestry game: Why bamboo should win but will not. Thesis. The Fletcher School of Law and Diplomacy